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PHYSICS ABSTRACTS

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ABSTRACTS 767–986

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331.8 : 782/785 *see Abstr.* 982/986

511.29 767

A table of partitions. TODD, J. A. *Proc. Lond. Math. Soc.*, 48, *pp.* 229–240, *Dec.*, 1943.—The present table contains, for $1 \leqslant n \leqslant 100$, $1 \leqslant m \leqslant [\frac{1}{2}(n+1)]$ the values of $p(n, m)$, the number of partitions of the positive integer n into exactly m parts. L. S. G.

511.43 768

On the class-numbers of binary quadratic forms. GUPTA, H. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 283–299, *Dec.*, 1942.—The form $F \equiv ax^2 + bxy + cy^2$ for which $D = b^2 - 4ac$ is a negative integer $-d$, is said to be primitive if $(a, b, c) = 1$. Under the linear transformation $\xi = \alpha x + \beta y$, $\eta = \gamma x + \delta y$, F becomes F^* with a determinant $(\alpha\delta - \beta\gamma)^2 D$, and if $\alpha\delta - \beta\gamma = 1$, the forms F and F^* are said to be properly equivalent. A complete set of properly equivalent forms is said to form a class. Tables are given of $h'(d)$, the number of properly primitive classes of forms of a negative determinant $-d$, where $d \leqslant 12\,500$. L. S. G.

511.53 769

On numbers represented by binary cubic forms. MORDELL, L. J. *Proc. Lond. Math. Soc.*, 48, *pp.* 198–228, *Dec.*, 1943.—Let $f(x, y) = ax^3 + bx^2y + cxy^2 + dy^3$ where a, b, c, d are real numbers, and let D denote the determinant of f, namely $D \equiv 27a^2d^2 - 18abcd - b^2c^2 + 4ac^3 + 4db^3$. Two main theorems are proved: I. If $D < 0$, integer values of x, y, not both zero, exist such that $|f(x, y)|^4 \leqslant |D|/49$, where the equality sign is necessary when and only when $D = -49e^4$ and $f(x, y)/e \sim x^3 + x^2y - 2xy^2 - y^3$, where e is an arbitrary constant. II. If $D > 0$, integer values of x, y, not both zero, exist such that $|f(x, y)|^4 \leqslant D/23$ where the equality sign is necessary when and only when $D = 23e^4$ and $f(x, y)/e \sim x^3 - xy^2 - y^3$, where e is an arbitrary constant. Various alternative forms of the theorems are given, referred to the lattice L given by $x = \alpha\xi + \beta\eta, y = \gamma\xi + \delta\eta$, where $\alpha, \beta, \gamma, \delta$ are real numbers, $\alpha\delta - \beta\gamma = 1$, and ξ, η run through all integer values. L. S. G.

512.83 = 6 770

Expression of matrix algebras as crossed products. BERRA, A. E. SAGASTUME. *Publ. Fac. Cienc. Fis.-Mat. La Plata*, *No.* 168, *pp.* 365–381, *June*, 1943.—A generalization of a theorem concerning the expression of the algebra M of all nth-degree matrices in elements of K, in the form of a crossed product (N^*, g), already known when g (a finite nth-order group) is cyclic.

512.83 = 6 771

Dihedric algebras. BERRA, A. E. SAGASTUME. *Publ. Fac. Cienc. Fis.-Mat. La Plata*, *No.* 168, *pp.* 383–393, *June*, 1943.—A study of crossed products in cases where the nth-order groups involved are not cyclic but dihedric.

512.831 772

Some new methods in matrix calculation. HOTELLING, H. *Ann. Math. Statist.*, 14, *pp.* 1–34, *March*, 1943.—The paper is concerned chiefly with methods of finding the inverse of a matrix, and of finding the latent roots and latent vectors. Iterative and direct methods are fully discussed and compared, and the practical aspect of matrix computation receives special emphasis. The accuracy of several of the processes is discussed and, in the case of iterative processes, limits are found for the errors introduced by stopping at any stage in the iteration. A valuable bibliography of related topics is given. L. S. G.

512.88 : 512.972 773

Invariant theory, tensors and group characters. LITTLEWOOD, D. E. *Philos. Trans. A*, 239, *pp.* 305–365, *Feb.* 4, 1944.—The theory of the tensor as a device for the construction of concomitants is developed. This includes the specific separation of a complete cogredient tensor of rank r into simple tensors, with a formula indicating the corresponding separation of a mixed tensor; also the corresponding theory in tensors to the Clebsch theory of algebraic forms, and a compact proof of the fundamental theorem that all concomitants under the full linear group can be obtained by the multiplication and contraction of tensors. Analysis of the properties of S-functions provides methods for predicting the exact number of linearly independent concomitants of each type, of a given set of ground forms. For ternary perpetuants a generating function is obtained. Extension is made to any number of variables. The complete sets of concomitants, up to degree 5 or 6 in the coefficients, are obtained for the cubic, quartic and quadratic complex in any number of variables. Alternating concomitant types are described and enumerated. A theorem of conjugates is proved which associates the concomitants of one ground form with the concomitants of a ground form of a different type. Indication is made of the extension of this theory to invariants under restricted groups of transformations.

512.972 : 512.88 *see Abstr.* 773

512.98 774

On the independence of operators on a lattice. HAIGHT, F. *Proc. Iowa Acad. Sci.*, 48, *pp.* 301–304, 1941.—Starting with a set A, and an undefined operator of derivation d, 9 basic first-order operators are introduced. From these 162 second-order operators are obtained, a second-order operator being one containing exactly 2 basic operators. It is shown that 86 of these operators are reducible, that is, equal to another operator of lower order; and that the remaining 76 are irreducible. L. S. G.

513.272 775

The Apollonian packing of circles. KASNER, E., AND SUPNICK, F. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 378–384, *Dec.*, 1943.—Let $T(a, b, c)$ denote the curvilinear triangle formed by 3 mutually and externally tangent circles of radii a, b and c. In this triangle a circle is inscribed, thereby forming 3 curvilinear triangles. In each of these, circles are inscribed and the process is continued indefinitely. The resulting configuration is called an Apollonian packing of circles. An analytic proof is given of the theorem: the sum of the areas of the infinity of circles of an Apollonian packing in $T(a, b, c)$ is equal to the area of $T(a, b, c)$. L. S. G.

513.311 776

To distinguish the two bisector planes of the angles between two given planes. OZA, H. P. *J. Univ. Bombay*, 12, *p.* 22, *Nov.*, 1943.

513.579 777

The contact net of quadrics. EDGE, W. L. *Proc. Lond. Math. Soc.*, 48, *pp.* 112–121, *July*, 1943.—Some properties are obtained of a net of quadric surfaces which is so specialized that its 8 base points coincide in pairs. The quadrics of the net (called a contact net) thus circumscribe a tetrahedron T and have a definite tangent line at each vertex of T. The figure cannot be set up arbitrarily but is restricted by the theorem: A necessary and sufficient condition for the lines $\alpha, \beta, \gamma, \delta$ to be tangent lines, at the vertices A, B, C, D of a tetrahedron T, of a net of quadrics, is that their respective intersections A', B', C', D' with the opposite faces of T form, with the vertices of T, a pair of Möbius Tetrads. It is shown that a contact net may be derived from a Möbius net (described in a previous paper by the author) and from a quartic scroll.

L. S. G.

513.624 778

The maximum number of lines lying on a quartic surface. SEGRE, B. *Quart. J. Math.*, 14, *pp.* 86–96, *Dec.*, 1943.—The number is proved to be 64 in the case of a non-singular quartic surface. The paper commences with certain general properties on surfaces containing lines. Some of these properties concern quartic surfaces only. Others are established for surfaces of arbitrary order and lead to the result: The number of lines lying on a non-singular surface F_n of order $n > 4$ cannot exceed $(n-2)(11n-6)$.

L. S. G.

513.72 779

The figure of six points in space of four dimensions. BRONOWSKI, J. *Quart. J. Math.*, 14, *pp.* 5–15, *June*, 1943.—$A_1, \ldots, A_6$ are 6 generic points of a [4], S. There are ∞^3 normal rational quartic curves (q) through $A_1, \ldots, A_6$ and ∞^4 cubic primals R having nodes at $A_1, \ldots, A_6$. The paper consists of a study of (i) the lines on a primal R, (ii) the trisecant planes of the curves (q), (iii) the representation of the system on a 10-nodal Segre cubic primal K. In this representation a curve q corresponds to a point of K, and the representation is studied in detail in order to trace the relation between the reducible curves q and the familiar special elements of K.

L. S. G.

513.73 : 531.35 780

Geometry of dual-velocity systems. CICCO, J. DE. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 261–270, *Dec.*, 1942.—A dual-velocity system of curves is an ∞^2 system given by the equation $dy^2/dx^2 = a(x,y)dy/dx + b(x,y)$. Here (x, y) are the equilong co-ordinates of a straight line. The geometry of some types of dual-velocity systems is studied and these types are characterzied as follows: Dual-natural system: $a_y \equiv 0$. Equitangential system: $a_x \equiv b_y$. Dual-Γ_0 system: $a_y \equiv 0$; $a_x \equiv b_y$. Δ-system: $a \equiv -2\psi_x/\psi + \phi_{xx}/\phi_x$, $b \equiv (\phi_{xx}\psi_x - \phi_x\psi_{xx})y/\psi\phi_x + (\phi_{xx}X_x - \phi_x X_{xx})/X\phi_x$, where ϕ, ψ and X are arbitrary functions of x. Dual-Γ' system: $a_y \equiv 0$, $b_{yy} \equiv 0$; $b_y - a_x \neq 0$, $b_{xy} + a_{xx} + 2a(b_y - a_x) = 0$. The author points out the relationship of these dual-velocity systems to the velocity systems introduced by Kasner in his investigation of the differential geometric aspects of positional fields of force.

L. S. G.

513.732 : 629.12 : 518 *see Abstr.* 802

513.735 = 6 781

The isoperimetric inequality upon surfaces of constant negative curvature. SANTALO, L. A. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 243–259, *Dec.*, 1942.—On a surface of const. curvature $K = -1$, let C be a convex figure of length L enclosing an area F. A proof is given of the inequality $L^2 - F^2 - 4\pi F \geqslant 0$, the equality holding in the case of a circular geodesic C_0 for which, if its radius is R, we have $L_0 = 2\pi \sinh R$, $F_0 = 2\pi(\cosh R - 1)$. The following two theorems are also deduced: (i) a sufficient condition that C be contained in C_0 is $L - F \coth (R/2) > \sqrt{\{L^2 - F(4\pi + F)\}}$. (ii) a sufficient condition that C contain C_0 is $L - (4\pi + F) \tanh (R/2) > \sqrt{\{L^2 - F(4\pi + F)\}}$.

L. S. G.

513.735.8 782

On the surfaces whose asymptotic curves of one system are projectively equivalent. CHENKUO PA. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 341–349, *Dec.*, 1942.—An alternate proof is given of a theorem due to Blaschke: if the asymptotic curves of one system on a non-ruled surface belong to linear complexes, then these curves are projectively equivalent. The converse of this theorem for ruled surfaces has been recently established by Fubini, whose result is also generalized here to non-ruled surfaces. In this case we obtain, besides the surfaces whose asymptotic curves of one system belong to linear complexes, one and only one class of ∞^2 projective minimal surfaces of coincidence.

L. S. G.

513.736 783

A generalization of the canonical quadric of Wilczynski in the projective theory of non-holonomic surfaces. BUCHIN SU. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 351–362, *Dec.*, 1942.—Bompiani's definition of the canonical quadric of Wilczynski is generalized to the projective differential geometry of a non-holonomic surface V_3^2 in ordinary space. The analogue of the canonical quadric so derived is used to characterize geometrically the quadrics of the Darboux pencil associated with a generic point of V_3^2. The quadric of Fubini is also generalized to a non-holonomic surface.

L. S. G.

513.738 : 517.54 *see Abstr.* 795

513.761.5 : 531 : 532.5 = 6 784

Introduction to the study of the principle of similarity and the method of models. LANGMANN, M. F. F. *Publ. Fac. Cienc. Fis.-Mat. La Plata, No.* 168, *pp.* 395–442, *June*, 1943.—In geometric similarity, concerning length, area and volume, one scale determines the other 2. In kinematics, 2 systems are similar if (1) they are geometrically similar in homologous instants and (2) their trajectories are similar. A velocity scale is added to the geometric scale. In mechanics there is, further, a mass scale. The use of models involves partial similarity only, as the proportional effects of forces acting (gravity, surface effects) depend on size. Applications to hydraulics are discussed.

513.774 : 519.49 785

Foundations of a general theory of birational correspondences. ZARISKI, O. *Trans. Amer. Math. Soc.*,

53, *pp.* 490–542, *May*, 1943.—Valuation theory is used in developing systematically the fundamental concepts and theorems of the theory of birational correspondences between algebraic varieties, with or without singularities, over an arbitrary ground field. Homogeneous ideals, homogeneous and non-homogeneous co-ordinates and valuation theory, are treated. Part II commences with the valuation-theoretic definition of a birational correspondence and then the birational correspondence between V and a derived normal model $\bar{V}$ is discussed. The fundamental varieties of a birational correspondence and some properties of these are treated and the paper concludes with a discussion of isolated fundamental varieties and monoidal transformations. L. S. G.

513.811.3 786

On isotropic spaces. MOGHE, D. N. *J. Univ. Bombay*, 12, *pp.* 1–3, *Nov.*, 1943.

513.813 : 517.947.44 : 535.13 *see Abstr.* 863

513.83 787

A new proof of a formula of Kuratowski. CHITTENDEN, E. W. *Proc. Iowa Acad. Sci.*, 48, *pp.* 299–300, 1941.—In a topological space the operation of closure is denoted by e and the interior i of a set A is defined by $iA = cecA$ where cA denotes the complement of A. A proof is given of the formula $(ei)^2A = eiA$, utilizing operations on the elements of a partially ordered set.

515.6 788

Trimetric projection. FAWCETT, H. *Metrop. Vick. Gaz.*, 20, *pp.* 264–268, *Jan.*, 1944.—"Picture" drawings, which can be readily understood by those unaccustomed to reading "flat" drawings may be made by means of "trimetric projection." A "trimetric scale" has been produced which gives the draughtsman a choice of any one of 12 points of view. Illustrations are given and the chief advantages of the technique are listed. L. S. G.

517.512.2 789

Fourier series and primitive characters. GUINAND, A. P. *Quart. J. Math.*, 14, *pp.* 79–81, *Dec.*, 1943.—Two theorems are proved concerning Fourier series having primitive characters as coefficients. Examples are given. L. S. G.

517.512.2 : 517.946 : 534.112 790

The resolution of boundary-value problems by means of the finite Fourier transformation: general vibration of a string. BROWN, H. K. *J. Appl. Phys.*, 14, *pp.* 609–618, *Nov.*, 1943.—The finite sine and cosine transformations are defined as $S\{G\} = \int_0^\pi G(x) \sin nx dx = g_s(n)$ and $C\{G\} = \int_0^\pi G(x) \cos nx dx = g_c(n)$, respectively. The finite sine transformation is applied to a boundary-value problem of a general vibrating string, in which the partial differential equation has coefficients which may be functions of the time. A resolution is made of the transformed problem by the introduction of a fundamental set of solutions of the homogeneous transformed problem; an inversion in closed form is accomplished. A formal verification is made and a survey of the applicability of the finite Fourier transformation to problems in engineering and physics is given.

517.512.2 : 778.3 791

Harmonic analysis by photographic method. STRAITON, A. W., AND TERHUNE, G. K. *J. Appl. Phys.*, 14, *pp.* 535–536, *Oct.*, 1943.—Describes a method for determining Fourier series coefficients from area measurements on photographs of the function to be analysed, with the graph sheet formed into a series of semi-cylinders.

517.52 = 69 792

On series of functions which are almost always absolutely divergent. NACHBIN, L. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 311–315, *Dec.*, 1942.—Necessary and sufficient conditions are found in order that, given a series of functions $\{\phi_m(x)\}$ and an absolutely divergent series $\sum\lambda_m$, the series $\sum\lambda_m\phi_m(x)$ shall be absolutely divergent. L. S. G.

517.53 793

A uniqueness theorem for mean values of analytic functions. FUCHS, W. H. J. *Proc. Lond. Math. Soc.*, 48, *pp.* 35–47, *June*, 1943.—A proof is given of the following theorem: If $f(z)$ and $g(z)$ are regular in the annulus A: $a < |z| < b$, and if, for a fixed positive λ, $M_\lambda(r, f) = M_\lambda(r, g)$ for an infinity of r with a limiting value $R(a < R < b)$, where $M_\lambda(r, f) = \left(\frac{1}{2\pi}\int_{-\pi}^{\pi} |f(re^{i\theta})|^\lambda d\theta\right)^{1/\lambda}$ and $M_\lambda(r, g)$ is given by a similar expression, with g in place of f, then $M_\lambda(r, f) = M_\lambda(r, g)$ in A. L. S. G.

517.531 794

On the coefficients of subordinate functions. ROGOSINSKI, W. *Proc. Lond. Math. Soc.*, 48, *pp.* 48–82, *June*, 1943.—Let D be a simply connected domain on the z-sphere, and let $W = F(z)$ and $w = f(z)$ be meromorphic in D. Denote by $G(F)$ the Riemann domain, extended over the W-sphere, which corresponds to the transform of D by $F(z)$. Then $f(z)$ is called subordinate to $F(z)$ in D, with centre z_0, if $f(z_0) = F(z_0)$, (z_0 in D), and if the values w of $f(z)$ in D, determined by analytical continuation from z_0, are situated in $G(F)$. Write $F(z) = A_1z + A_2z^2 + \ldots + A_nz^n + \ldots$, $f(z) = a_1z + a_2z^2 + \ldots + a_nz^n + \ldots$, these expansions being convergent near $z = 0$. The paper is concerned with relations betw. the coefficients a_n and A_n, when $f(z)$ is subordinate to $F(z)$. Two important results are: (i) If the numbers $A_1, A_2, \ldots, A_n$ are non-negative, non-increasing, and convex, then $|a_n| \leqslant A_1$. (ii) If the numbers $A_1, A_2 \ldots, A_n$ are non-negative, non-decreasing, and convex, then $|a_n| \leqslant A_n$. Subordination to schlicht functions $F(z)$ is also discussed. L. S. G.

517.54 : 513.738 795

An extensive class of transformations of isothermal families. KASNER, E., AND CICCO, J. DE. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 271–282, *Dec.*, 1942.—The paper is a generalization [Abstr. 2759 (1942)] to field-element transformations, a field-element being defined as (x, y, θ, r, s) where (x, y) are the Cartesian co-ordinates of a point, θ the inclination of the direction and $r = \theta_x$, $s = \theta_y$. In the complex plane, all field-element to lineal-element transformations which preserve the isothermal character consist of 7 distinct types, and there are 9 distinct types of contact field-element transformations which preserve the

isothermal character. In the real plane, excluding the degenerate cases, the set of all field-element to lineal element transformations which preserve the isothermal character is $X = \phi(x, y, r, s)$, $Y = \psi(x, y, r, s)$, $\Theta = a\theta + h(x, y, r, s)$, where ϕ and ψ satisfy the Cauchy–Riemann equations (both direct and reverse) for the complex variables $x + iy$ and $r + is$, $\phi_x = \pm \psi_y$, $\phi_y = \mp \psi_x$, $\phi_r = \mp \psi_s$, $\phi_s = \pm \psi_r$, h is a biharmonic function, $h_{xx} + h_{yy} = 0$, $h_{xr} - h_{ys} = 0$, $h_{xs} + h_{yr} = 0$, $h_{rr} + h_{ss} = 0$, and a is a const. The complete group of contact field-element transformations, which preserve the isothermal character, is also specified. L. S. G.

517.544 : 539.385 796

Torsion of hollow cylinders. BARTELS, R. C. F. *Trans. Amer. Math. Soc.*, 53, *pp.* 1–13, *Jan.*, 1943.—A method is developed for obtaining a computable solution of boundary-value problems of Dirichlet type for doubly connected regions, and an application is given to the torsion problem for certain hollow cylinders. The doubly connected region is mapped conformally upon an annulus and the related Dirichlet problem for the annulus is then solved. L. S. G.

517.544.2 797

On harmonic functions. SIRCAR, H. *Bull. Calcutta Math. Soc.*, 35, *pp.* 71–75, *June*, 1943.—In a circular area bounded by a chord, an analytic function $f(z) = u + iv$ is found, such that u has a prescribed value on the bounding chord and the normal derivative $\partial u/\partial n$ vanishes on the circular boundary. L. S. G.

517.564.3 : 539.11 : 530.145.61 *see Abstr.* 819

517.566.3 798

A method for the calculation of the zeta-function. TURING, A. M. *Proc. Lond. Math. Soc.*, 48, *pp.* 180–197, *Dec.*, 1943.—Using the approx. functional equation for the zeta-function $\zeta(s)$, $s = \sigma + it$, a formula is developed, which can be used to calculate $\zeta(s)$. It is applicable for all values of s but is likely to be most valuable for a range of t where t is neither so small that the Euler–Maclaurin summation method can be used (e.g. $t > 30$) nor large enough for the Riemann–Siegel asymptotic formula (e.g. $t < 1\,000$). L. S. G.

517.65(083.5) 799

Note on tables of an integral. FLETCHER, A. *Phil. Mag.*, 35, *pp.* 16–17, *Jan.*, 1944.—[See Abstr. 2660 (1943)]. A comparison with similar tables.

517.812 800

Some uses of the second M.V.T. for integrals. HEBALKAR, G. K. *J. Univ. Bombay*, 12, *pp.* 18–21, *Nov.*, 1943.—The theorem is applied to Abel's and Dirichlet's tests for uniform convergence of an integral and for ordinary convergence of improper integrals of the second kind.

517.946 : 534.112 : 517.512.2 *see Abstr.* 790

517.947.44 : 513.813 : 535.13 *see Abstr.* 863

517.949.2 = 6 801

A note on arithmetic triangles. BABINI, J. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 301–310, *Dec.*, 1942.—A study of the properties of the function $\phi(m, r)$ (where m and r are integers) satisfying the conditions: (1) $\phi(0, 0) = 1$; (2) $\phi(m, r) = 0$ when $r > m$; (3) $\phi(m, r) = f_1(m - r, r)\phi(m - 1, r - 1) + f_2(m - r, r)\phi(m - 1, r)$, where f_1 and f_2 are given finite functions. $\phi(m, r)$ is expressed explicitly in terms of f_1 and f_2 and examples and applications are given. L. S. G.

518 : 513.732 : 629.12 802

A new method of approximate quadrature. SPARKS, W. J. C. *Trans. Instn Nav. Archit., Lond.*, 85, *pp.* 104–117, 1943.—The paper describes a method of approx. calculating, for water-line curves, the area coeff., the transverse m. of i., the centre of flotation and the longitudinal m. of i., when given the overall length and breadth, and 4 other breadths only, 2 equally spaced in each of the forward and after bodies.

518.3 : 532.13 803

Nomograph for apparent viscosity of sulphite stock. DAVIS, D. S. *Industr. Engng Chem.*, 35, *p.* 1128, *Oct.*, 1943.

518.3 : 621.3.011.3 804

An alignment chart for finding the true inductance of a coil with distributed capacity. PAINE, R. C. *Communications*, 23, *pp.* 60 *and* 104, *Sept.*, 1943.

518.5 : 621.3.011.2 805

***RSS* and parallel *R–X* slide rules.** BROWN, W. G. *Communications*, 23, *pp.* 70–72 *and* 120, *Oct.*, 1943.—[See Abstr. 2664 (1943)].

519.1 806

Note on combinatorial analysis. RADO, R. *Proc. Lond. Math. Soc.*, 48, *pp.* 122–160, *July*, 1943.—If A is a set of numbers, the system of equations $a_{\mu 1}x_1 + a_{\mu 2}x_2 + \ldots + a_{\mu n}x_n = b_\mu (1 \leqslant \mu \leqslant m)$, where $a_{\mu\nu}$ and b_μ are complex numbers, is said to be regular in A if the following condition holds: however we split A into a finite number of subsets $A_1, A_2, \ldots, A_\kappa$, always at least one of these subsets contains a solution of the system of equations. Necessary and sufficient conditions for regularity, expressed in terms of linear relations between the $a_{\mu\nu}$, b_μ are established in the following cases: (1) The $a_{\mu\nu}$ are arbitrary, $b_\mu = 0$, A is the set of all numbers different from zero contained in a given ring of complex numbers. (2) The $a_{\mu\nu}$ and b_μ are arbitrary numbers, A is the field of all algebraic numbers. (3) The $a_{\mu\nu}$ are algebraic numbers, the b_μ are arbitrary, A is the field of all complex numbers. L. S. G.

519.214.3 807

A note on Poisson distribution. PILLAI, K. S. *Proc. Indian Acad. Sci. A*, 18, *pp.* 179–189, *Oct.*, 1943.—An estimate, based on the method of least squares, is obtained for the parameter in the Poisson distribution. The statistic obtained is found to satisfy the condition of consistence but not the criterion of sufficiency. The std. error and efficiency are determined and also an asymptotic value for the latter. L. S. G.

519.271.3 808

Relations between statistics: the general and the sampling problem when the samples are large. GEARY, R. C. *Proc. Roy. Irish Acad. A*, 49, *pp.* 177–196, *Dec.*, 1943.—Application of the results of a previous paper [Abstr. 1722 (1942)], to statistical data are considered. The problem of finding a meaning for relationship as applied to such data is dealt with, attention being confined to linear relationship. Conditions for the existence of such are given. The sampling problem is discussed in considerable detail, and it is shown how to determine the fiducial or confi-

dence limits of the estimates of the coefficients of the relationship. The theory only applies when the number of sets of observations is large. L. S. G.

519.4 809

Groupoids and their automorphisms. RICHARDSON, A. R. *Proc. Lond. Math. Soc.*, 48, *pp.* 83–111, *July*, 1943.—A groupoid is defined to be a system, of finite or infinite order, closed to a binary operation. The paper consists of a discussion of theorems relating to such systems. Restrictive postulates such as the associative and commutative laws are only introduced in a few theorems and then only in a weak form. The principal theorems relating to the automorphisms of associative linear algebra are shown to be special cases of theorems in which the full associative law is not assumed. L. S. G.

519.49 : 513.774 *see Abstr.* 785

519.5 810

Some set-theoretical properties of graphs. ERDÖS, P. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 363–367, *Dec.*, 1942.—Two theorems relating to graphs of points in the interval (0, 1) are proved. The first of these reads: Let a and b be infinite cardinals such that $b > a^a$. If we split the complete graph of power b into a sum of a subgraphs at least one of them contains a complete graph of power $> a$. L. S. G.

519.5 811

Concerning continua which have dendratomic subsets. MOORE, R. L. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 384–389, *Dec.*, 1943.—A dendratomic subset of a compact continuum is defined and also a web and a webless continuum. Various theorems are proved, incl. one giving the necessary and sufficient condition that a compact continuum shall have dendratomic subsets. L. S. G.

519.5 812

Concerning webs in the plane. MOORE, R. L. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 389–393, *Dec.*, 1943.—A continuation of a previous paper [Abstr. 811 (1944)]. It is not true that every continuum which is not a web is webless. However, we have the theorem: In the plane, if a compact continuum contains a web then it is a web. L. S. G.

521.153 : 530.12 813

Relativistic distributions of matter of radial symmetry. PATWARDHAN, G. K., AND VAIDYA, P. C. *J. Univ. Bombay*, 12, *pp.* 23–36, *Nov.*, 1943.—Several new solutions of Einstein's field equations having possible astronomical applications are obtained. Many of Tolman's new solutions [Abstr. 1548 (1939)] are derived by adopting a more general procedure. The equation of isotropy is integrated in one particular form. A perfectly general solution for a static spherical distribution is given correct to the third order of the destiny. The question of the energy of such distributions is considered.

523.13 814

New planetary systems. SEN, H. K. *Phys. Rev.*, 64, *p.* 376, *Dec.* 1 *and* 15, 1943.

523.746 815

Provisional sunspot-numbers for April to September, 1943. BRUNNER, W. *Terr. Magn. Atmos. Elect.*, 48, *p.* 214, *Dec.*, 1943.

523.746 816

Predictions for the coming sunspot-cycle. GLEISSBERG, W. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 243–244, *Dec.*, 1943.—A table gives some results of the calculations on probability concerning the next spot-cycle which will begin very probably before 1945.

523.746 : 550.384 *see Abstr.* 975

525.37 : 531.551.011 *see Abstr.* 828

527 : 538.7(09) *see Abstr.* 924

530.12 : 521.153 *see Abstr.* 813

530.12 : 531.18 817

Relativistic mechanics. III. Mechanics in 4-space, and conservative fields of force. WALKER, A. G. *Proc. Lond. Math. Soc.*, 48, *pp.* 161–179, *Dec.*, 1943.—The results of two previous papers are extended to 4-space maps S_4 and Σ_4. The procedure is to extend definitions and formulae from Σ_3 to Σ_4, both with τ-time, and then to transform to S_4 and t-time. L. S. G.

530.145.6 = 6 818

The ring of spin 1. KNIE, G. *Rev. Electrotecn.*, 29, *pp.* 599–600, *Nov.*, 1943.—Using the matrices $\sigma_1 = \begin{pmatrix} 0&0&1 \\ 0&0&0 \\ 1&0&0 \end{pmatrix}$, $\sigma_2 = \begin{pmatrix} 0&0&0 \\ 0&0&1 \\ 0&1&0 \end{pmatrix}$ the wave equation $\frac{\partial^2\phi}{\partial x_1^2} + \frac{\partial^2\phi}{\partial x_2^2} = \phi$ can be written as $\Psi = \left(\sigma_1\frac{\partial}{\partial x_1} + \sigma_2\frac{\partial}{\partial x_2}\right)\Psi$ where Ψ is a vector with components $\frac{\partial\phi}{\partial x_1}$, $\frac{\partial\phi}{\partial x_2}$, ϕ. If we introduce σ_3 defined by $i\sigma_3 = \sigma_1\sigma_2 - \sigma_2\sigma_1$ we obtain 3 components of spin 1, and the σ's take the proper values $-1, 0, 1$. By considering products of powers it is shown that σ_1, σ_2, σ_3 generate a ring containing 10 linearly independent terms, 1, σ_1, σ_2, σ_3, $\sigma_2\sigma_3$, $\sigma_3\sigma_1$, $\sigma_1\sigma_2$, σ_1^2, σ_2^2, σ_3^2. Various properties of this ring are discussed and it is shown that the ring is a subring of the ring of 126 terms introduced by Kemmer [Abstr. 4466 (1939)]. L. S. G.

530.145.61 : 539.11 : 517.564.3 819

Energy eigenvalues for the Coulomb potential with cut-off. I. WANNIER, G. H. *Phys. Rev.*, 64, *pp.* 358–366, *Dec.* 1 *and* 15, 1943.—The Schrödinger equation is solved analytically for the Coulomb potential with horizontal cut-off. A mathematical study of the confluent hypergeometric functions is carried out and their similarity to Bessel and Neumann functions is put on a quantitative basis. The resulting formulae for the energy levels are valid for all cases except when the energy is very little above the cut-off.

530.15 820

Newton's third law of motion as presented in textbooks of physics. LINDSAY, G. A. *Amer. J. Phys.*, 11, *pp.* 319–323, *Dec.*, 1943.—In many instances there is an apparent lack of appreciation of the very simple significance of the law. It is not realized that the forces of action and reaction are on different bodies, and the equality of action and reaction is confused with the condition for equilibrium of a body. Quotations are given. G. E. A.

530.16 821

Quantized probability. GOLDSMITH, A. N. *Phys. Rev.*, 64, *pp.* 376–377, *Dec.* 1 *and* 15, 1943.

531 : 532.5 : 513.761.5 = 6 *see Abstr.* 784

531.18 : 530.12 *see Abstr.* 817

531.19 : 532.7 : 533.7 822

On the statistical mechanics of liquids, and the gas of hard elastic spheres. RICE, O. K. *J. Chem. Phys.*, 12, *pp.* 1–18, *Jan.*, 1944.—A general discussion of communal entropy, arising from the sharing of available space by all the atoms, is given. For a gas of hard elastic spheres the communal entropy is fully excited in each direction of space, and amounts to $3R$ per mole. The communal entropy of assemblages of atoms exerting normal attractive and repulsive forces (in particular, the Debye solid) is considered. The geometry, the equation of state, and the partition function for an assemblage of hard elastic spheres are considered in detail. A general form of partition function for a monatomic liquid is set up as a sum of 2 parts, one corresponding to a vibrational motion expressed in terms of the Debye characteristic temperature of the solid, the other being a translational term, each part carrying its own communal entropy.

531.224.4 : 539.384.4 823

The buckling of grids of stringers and ribs. COX, H. L., AND SMITH, H. E. *Proc. Lond. Math. Soc.*, 48, *pp.* 1–26, *June*, 1943.—An exact solution is found for the problem of the buckling of a plane rectangular grid consisting of $m-1$ similar stringers of uniform section, each $2B$ long, spaced $2D/m$ apart, and cross-connected by $n-1$ similar ribs of uniform section, each $2D$ long, spaced $2B/n$ apart, when subjected to uniform compression in the direction of the stringers. The ends of both stringers and ribs are connected to edge members having half the torsional rigidities of the corresponding main members, and these edge members are held in the original plane. The solution is obtained both by considering the equations of equilibrium and by the Rayleigh–Ritz energy method. L. S. G.

531.224.4 : 539.384.4 824

The buckling of a thin sheet transversely stiffened. COX, H. L., AND SMITH, H. E. *Proc. Lond. Math. Soc.*, 48, *pp.* 27–34, *June*, 1943.—Using the Rayleigh–Ritz energy method, a theoretical analysis is given of the stability of a thin rectangular sheet with transverse ribs, simply supported at all edges, when subjected to compressive end load. A "buckling equation" has been obtained from which it is possible to calculate the requisite flexural stiffness of the ribs in any case, assuming a value for their torsional rigidity. Results of a previous paper [Abstr. 823 (1944)] are used. L. S. G.

531.226 825

The centre of shear again. OSGOOD, W. R. *J. Appl. Mech.*, 10, *A62–A64*, *Sept.*, 1943.—There is disagreement on the point in the cross-section at the free end of a cantilever beam at which a transverse load must be applied so that no rotation of the free end may occur in its own plane. The boundary conditions are examined and a definition of the centre of shear is proposed that leads to a unique point for any cross-section. G. E. A.

531.25 826

Deflection of uniformly loaded circular plates. OLSON, F. C. W. *J. Appl. Mech.*, 10, *A181–A182*, *Dec.*, 1943.—The equation for small deflections of a uniformly loaded and supported circular plate is rewritten so that the 2 const. of integration are interpreted as the centre deflection w_0 and a boundary parameter α. Stresses and b.m. are given in terms of w_0 and α. The nature of the support may be found experimentally even if the elastic const., plate thickness and load are unknown. The energy method is used to develop a more general theory of large deflections, valid for any condition of uniform support at the edge.

531.258 827

Some boundary problems of two-dimensional elasticity. STEVENSON, A. C. *Phil. Mag.*, 34, *pp.* 766–793, *Nov.*, 1943.—Boundary equations are set up in terms of 2 complex potentials, and solutions in certain simple cases are obtained by elementary tentative methods. The treatment by complex potentials has no explicit need for the Airy stress function. The method has been developed from the beginning to cope with problems involving body-force. G. E. A.

531.35 : 513.73 *see Abstr.* 780

531.551.011 : 525.37 828

Effects of form and rotation of the earth upon ranges of projectiles. KIRKPATRICK, P. *Amer. J. Phys.*, 11, *pp.* 303–311, *Dec.*, 1943.—The range given by $V_0^2 \sin 2\alpha/g$ is almost right in many cases, but if V_0 exceeds 11 050 m./s. it is not correct, even in order of magnitude. Correction terms are deduced to be added to the above for variation of g with altitude and latitude, curvature of the earth and change in the direction of g during flight in an equatorial plane. The methods are extended to the case of a projectile in any latitude and with any direction of projection. Orbital motion and air resistance are not included in the discussion. G. E. A.

531.78 : 621.317.39 829

Strain gauges. NIELSEN, D. M. *Electronics*, 16, *pp.* 106–111, 192 *and* 194, *Dec.*, 1943.—[Abstr. 760 B (1944)].

532.13 : 518.3 *see Abstr.* 803

532.133 : 539.501 : 532.77 *see Abstr.* 842

532.133 : 541.132 : 541.182.63 *see Abstr.* 959

532.133 : 541.68 : 547.21 830

Viscosity and structure of pure hydrocarbons. KIERSTEAD, H. A., AND TURKEVICH, J. *J. Chem. Phys.*, 12, *pp.* 24–27, *Jan.*, 1944.—The constants, A and E, of the equation, $\phi = A \exp(-E/kT)$, for the fluidity ϕ, are tabulated for a number of hydrocarbons. The variations of these constants with structure are discussed.

532.137 : 539.501 *see Abstr.* 941

532.14 : 535.324 : 541.265 : 532.612 *see Abstr.* 837

532.322 : 629.12 831

Stability coefficients. BURGESS, N. H. *Trans. Instn Nav. Archit., Lond.*, 85, *pp.* 83–94, 1943.—An investigation was made on 25 ships in order to compare the movement of the centre of buoyancy during the heeling of these vessels with that of a prism having a transverse section of the same midship area and shape as that of the particular ship for which the comparison is made, except that the depth of prism is increased by 1/3 of the mean deck shear.

532.5 : 531 : 513.761.5 = 6 *see Abstr.* 784

532.517 : 535.557 = 3 *see Abstr.* 893

532.525 : 662.61 832

Overfire air jets. ENGDAHL, R. B., AND HOLTON, W. C. *Trans. Amer. Soc. Mech. Engrs*, 65, *pp.* 741–754, *Oct.*, 1943.—[Abstr. 839 B (1944)].

532.54 833

Oscillations in closed surge tanks. BINNIE, A. M. *J. Appl. Mech.*, 10, *A*183–*A*186, *Dec.*, 1943.—A procedure is explained for calculating the max. pressure and expansion of the air, which result from a sudden shut-down of the plant. Friction is taken into account, both in the pipe and in any arrangement placed betw. the pipe and the tank to damp the oscillations, but the compression and expansion of the air must be assumed isothermal. Small-scale experiments confirmed the expectation that the observed max. pressures would be $>$ the theoretical.

532.582.7 834

The critical shear stress. QURAISHY, M. S. *J. Univ. Bombay*, 12, *pp.* 37–46, *Nov.*, 1943.—A theory of the transport of sediment by fluid currents, based on the supposition that the force impressed upon the moving particles of sediment, (sand), by the fluid is $\propto$ the gravitational force exerted on the particles when falling freely in the fluid, is developed. Values of the critical or threshold shear stress on the sediment bed derived from the theory agree with experimental results relating to the transport of sand, coal and mixtures of sand and coal obtained by 6 different experimenters. J. S. G. T.

532.583.4 : 629.12 835

Resistance of hulls of varying beams. EMERSON, A. *Trans. Instn Nav. Archit., Lond.*, 85, *pp.* 172–186, 1943.—A basic single-screw ship form has been changed in shape and beam to give a set of 9 models—3 different longitudinal distributions of displacement for each of 3 breadths. Each model was tested for resistance and propulsion and resistance measurements were made in waves. The experimental results and an outline of the factors causing ship resistance are given.

532.61 : 541.183 836

Adsorption as the cause of the phenomenon of the "floating drop," and foam consisting solely of liquids. BENEDICKS, C., AND SEDERHOLM, P. *Nature, Lond.*, 153, *pp.* 80–81, *Jan.* 15, 1944.—The phenomenon of drops floating on the surface of the same liquid is attributed to adsorption of a foreign substance (moisture, air, or oil) at the surface of the liquid. The phenomenon does not occur in vac. Experiments with ethanol and saponin, in support of this explanation, are described. A foam was produced consisting solely of liquids (cell walls saponin solution, cell content oil). N. M. B.

532.612 : 532.14 : 535.324 : 541.265 837

Physical properties and chemical constitution. VIII. Alkyl chlorides, bromides, and iodides. VOGEL, A. I. *J. Chem. Soc.*, *pp.* 636–647, *Dec.*, 1943.—Full data are reported for determinations of refr. indices for the *C*, *D*, *F*, and *G′* lines at 20°, and of the surface tensions and densities over a range of temps. for 52 alkyl halides. Mol. refractivities and parachors are evaluated, and the results for the *n*-halides used to calculate the CH_2 differences; these differ appreciably from the vals. hitherto accepted [see Abstr. 814 (1943)]. N. M. B.

532.613.4 838

The oil/water interface of mineral-oil/polar-compound mixtures. AICKIN, R. G. *J. Soc. Dy. Col., Bradford*, 60, *pp.* 41–43, *Feb.*, 1944.—The interfacial tension of various mixtures of mineral oil and polar compounds was measured and the packing of polar compounds at the oil/water interface determined. A stable 1 : 1 mineral-oil–polar-compound complex is present in the interface over a wide range of conc., regardless of the interfacial tension of the system. The presence of this 1 : 1 complex provides the basis of a simple mechanistic picture of the stability of emulsions stabilized by mixtures of oil-soluble and water-soluble polar compounds. The addition of glycerol mono-oleate reduces the interfacial tension of mineral oil against water to an extremely low figure, and it is effective in extremely low conc. Solutions of glycerol mono-oleate in mineral oil are micellar in nature.

532.614 : 536.658 839

Extension of the attractive energy of a solid into an adjacent liquid or film and the decrease of energy with distance. HARKINS, W. D., AND JURA, G. *J. Chem. Phys.*, 11, *pp.* 560–561, *Dec.*, 1943.—The experimental attack, briefly outlined, on this unsolved problem depends on a determination of the energy of immersion for the clean solid and for the solid covered with the adsorbed films of different thicknesses. Data are plotted for the decrease in energy of immersion of TiO_2 from H_2O as the thickness of the H_2O film increases. Relevant views on the mono- and polymolecular nature of adsorbed films are considered. N. M. B.

532.614 : 536.658 840

Relationship between the energy of adsorption of a vapour on a solid and of immersion of the solid in a liquid. JURA, G., AND HARKINS, W. D. *J. Chem. Phys.*, 11, *pp.* 561–562, *Dec.*, 1943.—The correct relation between the heats of adsorption and immersion are derived in place of the universally incorrect equations currently accepted. In the course of this the equation is deduced on which the experimental method is based [Abstr. 839 (1944)]. From such heats of immersion and condensation the heats of absorption of a vapour on a solid can be more accurately calculated than from any absorption method. N. M. B.

532.63 : 537.228 = 3 841

The theory of the capillary oscillations of a liquid drop. FIERZ, M. *Helv. Phys. Acta*, 16, 4, *pp.* 365–370, 1943.—Flügge [*Ann. Phys., Lpz.*, 39, p. 373, 1941] has described a study of the capillary oscillations of a charged drop, involving a calculation of the electromagnetic radiation from a drop whose oscillatory condition is represented by the quantum numbers *l*, *m*. The author shows that such a drop has an impulse moment about the *z*-axis, calculates this, the magnetic moment, and the radiation characteristic, and draws attention to an error in Flügge's calculation. A. E. T.

532.7 : 533.7 : 531.19 *see Abstr.* 822

532.77 : 532.133 : 539.501 842

The fluidity of electrolytes. II. BINGHAM, E. C., AND FOLEY, R. T. *J. Phys. Chem.*, 47, *pp.* 511–527, *Oct.*, 1943.—[See Abstr. 2163 (1941)]. The rheo-

logical data of mixtures of electrolytes are studied for the explanation of certain anomalies [*Wied. Ann.*, 42, p. 287, 1891; *J. Amer. Chem. Soc.*, 42, p. 1776, 1920]. Recalculation on the assumption that fluidities are normally additive, has reduced differences between observed and calculated values by 50%. The differences remaining are partly due to the dilution of each solute during the operation of mixing. A suggestion is made for a method of correction. Using $PbCl_2$ which gives a neg. value of ionic fluidity elevation and recalculating the value for $Pb(NO_3)_2$, it is found that the Grüneisen data give the ionic elevation −282. Fluidity data are given for mixtures of N solutions of NaCl and KCl at 25°C., of N solutions of $NaNO_3$ and KNO_3 at 10°, 20° and 30°C., and of 0·05 N solutions of LiF and KI at 25°. H. H. HO.

532.77 : 541.123.2 843

The system trimethyl-phosphate–acetic-acid. PAGEL, H. A., AND RUYLE, W. V. *J. Amer. Chem. Soc.*, 65, *p.* 2186, *Nov.*, 1943.—F.p. of trimethyl-phosphate–acetic-acid, involving both forms of the solid ester, were studied. The eutectic composition with the α form of solid ester was at 52·9 mole % of the ester with f.p. of (− 89·9 ± 1)°.

532.782 : 548.0 844

Report on the systems lead-oxide–alumina and lead-oxide–alumina-silica. GELLER, R. F., AND BUNTING, E. N. *J. Res. Nat. Bur. Stand., Wash.*, 31, *pp.* 255–270, *Nov.*, 1943.—Phase relations were studied for those portions of the binary and the ternary systems containing over 50% of PbO. It is reasonably certain that the binary system contains the compound $PbO \cdot Al_2O_3$. In the ternary system 3 compounds ($8PbO \cdot Al_2O_3 \cdot 4SiO_2$, $4PbO \cdot Al_2O_3 \cdot 2SiO_2$, and $6PbO \cdot Al_2O_3 \cdot 6SiO_2$) were identified, 4 others were indicated by optical and X-ray properties, and 10 quintuple points, which include 6 eutectics, were established. Also, Al_2O_3 (99·9 plus purity) was observed to melt at 2 035°C.

533.15 845

Thermal diffusion in mixtures of molecules of small mass difference. GREW, K. E. *Phil. Mag.*, 35, *pp.* 30–36, *Jan.*, 1944.—The thermal diffusion effect was examined in gas mixtures in which the difference in the mol. masses is small and the heavier molecule has the smaller dia. In such cases [Abstr. 170 (1941)] the thermal diffusion factor may be neg. (the heavier mol. diffuses up the temp. gradient), or it may change sign with changing proportions of the constituents. This change of sign was found to occur in Ne-NH_3 mixtures; it did not occur in A-HCl mixtures. N_2O-CO_2 mixtures were also examined. No reversal was found.

533.17.08 : 578.087.77 846

A flowmeter for use in air-sampling procedures. LEMON, H. M., AND WISE, H. *Science*, 99, *pp.* 43–44, *Jan.* 14, 1944.

533.6.013.42 : 534.13 : 629.12.037 847

Propeller blade vibration. TAYLOR, J. L. *Trans. Instn Nav. Archit., Lond.*, 85, *pp.* 142–156, 1943.—The possible modes of vibration are considered, with emphasis on the simpler types most likely to be involved, and the influence of the surrounding water; an attempt is made to link up with the well-established mathematical theory of aerodynamic flutter, adapted to the particular circumstances.

533.7 : 532.7 : 531.19 *see Abstr.* 822

534.1 : 621-272.1 848

Static and dynamic spring constants. The appropriate lumped constants of vibrating shaft systems. HORVAY, G., AND ORMONDROYD, J. *J. Appl. Mech.*, 10, *A213–A224*, *Dec.*, 1943.—[Abstr. 708 B (1944)].

534.112 : 517.946 : 517.512.2 *see Abstr.* 790

534.13 : 629.12.037 : 533.6.013.42 *see Abstr.* 847

534.141.4 849

A new sonic and ultrasonic generator to produce high intensities in gases. EHRET, L., AND HAHNEMANN, H. *Z. techn. Phys.*, 23, 10, *pp.* 245–267, 1942.—Describes in detail a new generator which utilizes a resonator mounted between a membrane and a compressed-air nozzle. Intensities of the order of 1 W/cm.², free from air flow, could be obtained. E. R. A.

534.213 850

Acoustical tables for air and sea water. WOOLF, W. L. *J. Acoust. Soc. Amer.*, 15, *pp.* 83–86, *Oct.*, 1943.—The tables contain the fixed relationships, for a sound wave in a non-changing medium, among sound pressure, intensity level, particle velocity and the product of particle displacement and frequency, in air and sea water, under the condition that $\rho \times c$ (density × velocity) is 40 c.g.s. for air and 150 500 for sea water. Equations connecting the quantities and reference values are added. G. E. A.

534.22 851

The extension of the Doppler principle to discontinuous periodic effects. FLEISCHMANN, L. *J. Acoust. Soc. Amer.*, 15, *pp.* 103–105, *Oct.*, 1943.—An elementary graphical demonstration that discontinuous periodic effects, such as the time between hits of bullets fired by a machine gun on a moving aircraft, are subject to a similar law of change of frequency as effects due to wave motion. G. E. A.

534.321.9 : 620.179.16 852

Detecting flaws with u.h.f. sound waves. TROST, A. *Sheet Metal Industr.*, *pp.* 255–257, *Feb.*, 1944.—[Abstr. 703 B (1944)].

534.321.9 : 620.179.16 : 669.14 853

Detection of cleavages in steel sheets by ultrasonic testing. TROST, A. *VDI* [*Z. Ver. dtsch. Ing.*], 87, *pp.* 352–354, *June* 12, 1943.—The use of ultrasonics is suitable for detection of doublings in sheets. An illustrated description of an instrument developed for rapid and continuous detection of such defects, which makes use of flowing water as a coupling link between the oscillating quartz, the work-piece and the receiver, is given. E. R. A.

534.321.9 : 621.791 854

A possible application of ultrasonics. BEHR, A. *Metal Ind., Lond.*, *p.* 422, *Dec.* 31, 1943.—Experiments have been carried out on the treatment of small melts by ultrasonic vibrations. A marked grain-refining effect was observed with Sb and Cd, and grain boundaries disappeared in the case of duralumin. The conditions in welding are suitable for the application of ultrasonics for the purpose of grain-refining and improving the properties of the weld metal. The field of application to spot welding is most promising. M.-V.

534.372 : 771.3 855

The vibration insulation of photographic equipment. FLETCHER, W. P. *Photogr. J.*, 84, *pp.* 38–40, *Feb.*, 1944.—Describes simple rubber mounting for a camera.

534.373 856

Use of the Pierce interferometer for measuring the absorption of sound in gases. HARDY, H. C. *J. Acoust. Soc. Amer.*, 15, *pp.* 91–95, *Oct.*, 1943.—A rigorous derivation of Pielemeier's empirical equation for the absorption of sound in gases is obtained by making use of the principles of the Pierce ultrasonic interferometer and the quartz oscillator. The Pielemeier method gives a fair approximation when the reaction of the sound wave on the crystal is small; it enables both velocity and absorption to be measured. The limits of precision in its use were tested experimentally and these agree with theory. G. E. A.

534.511 : 621.317.757 857

A machine for harmonic synthesis. SHILTON, A. *Proc. Phys. Soc., Lond.*, 56, *pp.* 130–132, *March*, 1944.

534.771 858

Estimation of percentage loss of hearing. CARTER, H. A. *J. Acoust. Soc. Amer.*, 15, *pp.* 87–90, *Oct.*, 1943.—Formulation of a simplified method that could serve as a recognized basis for estimating the p.c. loss in the average industrial or medico-legal case. An audiogram table sets out in db for the 4 octaves between frequencies 256 and 4 096 the p.c. losses of useful hearing to be assigned to each octave of the 4 that are accepted as essential to the interpretation of speech. Audiometer measurements having been taken, the computation runs: (*a*) 7 × total p.c. loss, better ear; (*b*) total p.c. loss, worse ear; (*c*) sum of (*a*) and (*b*); (*d*) item (*c*) ÷ 8, giving the combined p.c. loss for both ears. G. E. A.

534.837 859

A discussion of acoustic cells for airplane-engine test buildings. FITZROY, D. *J. Acoust. Soc. Amer.*, 15, *pp.* 106–113, *Oct.*, 1943.—The test room for aero-engines is usually provided with 2 tunnels, one at air intake and the other at the exhaust end. In the tunnels are built a series of parallel ribbon walls composed of porous cast stone, 1 ft. apart. The source of sound was an oscillator, set successively at 7 frequency bands from 50 to 3 200 c./s. With a selected frequency, readings of the change in db were taken at 30 in. intervals, starting at the inside face of the cell. The motor noises are assumed to be composed of 7 different noises of equal intensity; these have their major frequency peaks from 500 c./s. downwards. Five different types of cell were tested and the max. overall attenuation is tabulated, the greatest being 24·4 db. Motor tests agreed with oscillator tests, and both verify Sabine's formula. There is a practical limit to the reduction of motor test noise. G. E. A.

534.837 860

Sound-proof airplane-motor test chambers. KATEL, I. E. *J. Acoust. Soc. Amer.*, 15, *pp.* 114–115, *Oct.*, 1943.—The types of chamber described were of U-shape, either with chimneys at the ends of a horizontal chamber or in the form of a long horizontal tunnel. An absorbing covering is fixed to the walls and ceiling of the central part and the walls of the two tunnels. Abrupt entry of air is avoided at the intake and absorbing baffles are placed across both tunnels. Other precautions are mentioned. G. E. A.

534.842 861

Cinema sound quality. MOIR, J. *Wireless World*, 49, *pp.* 320–323, *Nov., and pp.* 362–366, *Dec.*, 1943.—Describes tests in different cinemas of the causes of variation in intelligibility of speech and "intimacy" (closeness of association of sound and picture). The tests show that reverberation times and frequency characteristics are not the main criteria by which to judge sound quality, and from a series of recorded sound impulses the following ideal requirements are drawn. The reverberation time (theatre empty) should approximate to that shown by a given optimum curve. The shape of the reverberation-time/frequency curve should approximate to another given curve. Reflection paths should not exceed the direct path by more than 45 ft. Unavoidable reflected-sound paths should subtend a small angle at any point in the audience. Suggestions are made from these for the improvement of hearing in the cinema or theatre. G. E. A.

534.844.1 = 3 862

On a device for investigating reverberation phenomena in closed rooms. BURGER, B. *Hochfrequenztechn. u. Elektroakust.*, 61, *pp.* 75–82, *March*, 1943.—[See Abstr. 3114 (1929)]. The intensity of reverberation in different directions is measured by a sound transmitter of const. intensity (a howling sound generator using a presaturated choking coil for modulation), and a receiver of const. sensitiveness (a piezo-electric microphone). Directional-intensity diagrams, and details of testing and application of apparatus, are given. R. N.

535.13 : 517.947.44 : 513.813 863

Development of electromagnetic theory for non-homogeneous spaces. LIEBOWITZ, B. *Phys. Rev.*, 64, *pp.* 294–301, *Nov.* 1 *and* 15, 1943.—If the permittivity of the space is a function $\varepsilon(x, y, z)$ of position, it is shown that, by introducing a Riemannian space whose line element $ds^2 = h^2(du_1^2 + du_2^2 + du_3^2)$, where $h^2 = 1/\varepsilon$, it is possible to derive a separate wave equation for each component of the field; that is, each equation contains only 1 component. If the electric vector is E, an auxiliary vector F, defined by $E = \Omega F/h$, is introduced where $\Omega \equiv \Omega(u_1, u_2, u_3)$. It is shown that, if Ω satisfies the equation

$$\frac{1}{\Omega}\frac{\partial^2\Omega}{\partial u_i \partial u_j} - \frac{1}{h}\frac{\partial^2 h}{\partial u_i \partial u_j} + \frac{1}{h^2}\frac{\partial h}{\partial u_i}\frac{\partial h}{\partial u_j} = 0 \quad i, j = 1, 2, 3, i \neq j,$$

the component F_1 of F is given by the equation

$$\sum \frac{\partial^2 F_1}{\partial u_i^2} - \frac{1}{c^2}\frac{\partial^2 F_1}{\partial t^2} - F_1 \times \left[\frac{1}{h\Omega}\sum \frac{\partial\Omega}{\partial u_i}\frac{\partial h}{\partial u_i} + \frac{1}{h}\frac{\partial^2 h}{\partial u_1^2} - \frac{1}{\Omega}\frac{\partial^2\Omega}{\partial u_1^2} - \left(\frac{1}{h}\frac{\partial h}{\partial u_1}\right)^2\right] + \sum \frac{\partial F_1}{\partial u_i}\frac{\partial}{\partial u_i}\log\frac{\Omega^2}{h} = \frac{h^3}{\Omega} \times \left(\frac{4\pi}{c}\frac{\partial J_1}{\partial t} + 4\pi h\frac{\partial \rho}{\partial u_1} + 16\pi\frac{\partial h}{\partial u_1}\rho\right)$$

Equations are also obtained for the components of the vector potential and for the scalar potential.

Simple electrostatic cases are discussed as well as some cosmological implications of the theory. L. S. G.

535.215.1-1 864

Inner photo-electric effect of selenium in the infra-red. WEIBULL, I. *Ark. Mat. Astr. Fys.*, 29*B*, 14, [16 *pp.*], 1943.—Three specimens of Se were examined, and the results are presented in curves showing photo-electric effect as a function of wave number. A critical point is found in the infra-red, akin to the critical point already known near the red end of the visible spectrum. The results are to be discussed in a later paper. A. E. T.

535.24 865

Annual Report of Committee on Instruments and Measurements. *Illum. Engng, N.Y.*, 38, *pp.* 509–517, *Nov.*, 1943.—A description of some photo-electric circuits used in photometric measurements on blackout lighting fittings and of a method for measuring atmospheric transmission. J. W. T. W.

535.243-1 : 621.317.794 866

A fast and sensitive bolometer and galvanometer system for an infra-red spectrometer. BAKER, E. B., AND ROBB, C. D. *Rev. Sci. Instrum.*, 14, *pp.* 356–359, *Dec.*, 1943.—The bolometer and associated equipment, designed for a high-speed recording *f*4 rocksalt infra-red spectrophotometer, respond in 0·2 sec. to 6×10^{-8} W of radiation from a slit. Amplification of the Brownian limit of the Moll microgalvanometer in the presence of difficult vibrations is achieved by mounting the galvanometer, photocells and pre-amplifier, on a novel support employing a large compression spring.

535.247.4 867

New type of microphotometer. PRINGLE, R. W. *Nature, Lond.*, 153, *pp.* 81–82, *Jan.* 15, 1944.—Describes an improved form of the instrument due to Fürth [Abstr. 2304 (1942)], in which the distribution of transparency along a straight line in a spectrum photograph is shown on a c.r.o. The present instrument provides a single trace instead of a double one and thus gives better definition and resolving power. J. W. T. W.

535.317 868

Gaussian optics and Gaussian brackets. HERZBERGER, M. *J. Opt. Soc. Amer.*, 33, *pp.* 651–655, *Dec.*, 1943.—The so-called "Gaussian Brackets," although originally a mathematical concept, can be useful in handling problems of Gaussian optics, and merit the attention of designers as a time-saving device in computing effects of changes in surface power. A point of departure for a broader understanding of the image errors of the general optical system is provided. A. H.

535.317 : 535.821 869

The design of a telephoto-magnifier. REISS, M. *J. Opt. Soc. Amer.*, 33, *pp.* 641–651, *Dec.*, 1943.—Deals with a number of points which have arisen in the course of the design of a Galilean loupe of the Brücke type. In the case of a complicated system such as this, the only method which can be used is to calculate the set-up by approx. algebraic methods and then, by analysis of the contributions of the various surfaces, decide what changes in the construction of the system are likely to reduce the aberrations to tolerable amounts. A. H.

535.317.9 870

Wide-aperture aplanatic single lenses. MARTIN, L. C. *Proc. Phys. Soc., Lond.*, 56, *pp.* 104–113, *March*, 1944.—The polar equation of an aspheric surface of an aplanatic single lens is given in series form, and 2 numerical examples are studied, one being an aplanat, the other an anastigmatic singlet free from primary and higher-order spherical aberration, offence against the sine condition, primary astigmatism, and curvature of field. The shape of the latter lens is predicted by Burch's 4-plate theorem, the results of which agree with the formulae given.

535.321.2 : 535.81 871

Measurement of the refractive index and dispersion of optical glass for control of product. GUREWITZ, H. L., AND TILTON, L. W. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 39 *et seq*, *Jan.*, 1944.—To facilitate spectrometer determinations, coefficients have been devised which, together with a table of natural sines and slide-rule operations, permit the computation of refr. indices of glass within $\pm 3 \times 10^{-6}$ from min. dev. data on prisms having angles of $60^{\circ} \pm 30'$.

535.322.1-1 : 535.339-1 872

High-speed automatic infra-red spectrometer. BAKER, E. B., AND ROBB, C. D. *Rev. Sci. Instrum.*, 14, *pp.* 362–367, *Dec.*, 1943.—A rocksalt, vacuum, double monochromator is described that displays the entire spectrum to 15 μ (or selected portions at higher resolution) in 1 min. on a long-persistence oscilloscope screen. It measures percent transmission directly, automatically correcting for source-intensity distribution and spectrometer losses. Special arrangements permit rapid preparation of samples for analysis. Reflection measurements and direct comparison of 2 emission sources can be made.

535.324 : 532.14 : 541.265 : 532.612 *see Abstr.* 837

535.33 : 544.6 873

Modern spectrochemical analysis. JAYCOX, E. K. *J. Appl. Phys.*, 14, *p.* 619–631, *Dec.*, 1943.—A general survey.

535.33 : 545.82 874

A compendium of line pairs and operating conditions used in spectrographic analysis. HODGE, E. S. *J. Opt. Soc. Amer.*, 33, *pp.* 656–659, *Dec.*, 1943.—Describes the technique employed in making a compendium (from the available literature) of line pairs and appropriate operating conditions suitable for use in quantitative spectrographic analysis. A. H.

535.33.03 : 537.54 875

Hydrogen discharge tube with metal capillary. LORENZ, E., AND KUECK, P. D. *J. Opt. Soc. Amer.*, 33, *pp.* 663–665, *Dec.*, 1943.—H discharge tubes with glass capillaries are fragile and can take only a limited current. These disadvantages are overcome by using a metal (Cu) capillary and metal-glass seals. The continuum obtained is identical with that emitted from a glass capillary both with regard to spectral distribution and intensity. A. H.

535.33.03 : 545.82 : 546.84 : 546.78 876

Spectrographic determination of thorium in tungsten filament wire. PARSONS, S. L. *J. Opt. Soc. Amer.*, 33, *pp.* 659–662, *Dec.*, 1943.—Describes the technique which has been developed to determine Th in W over the range 1% to 2%. An a.c. arc is used. An

accuracy sufficient for manufacturing control is obtained. A. H.

535.336.2 : 537.534 877

Discrimination in mass spectrometer ion sources. COGGESHALL, N. D. *J. Chem. Phys.*, 12, *pp.* 19–23, *Jan.*, 1944.—An analysis is made of the collection and definition of a beam of ions by an ion source. The first slit of the source has no discriminating effect, but the second has. This is due to the fact that ions of certain values of initial energy, angle of velocity vector, and position of striking the plane of the first slit, cannot get through the second one. An efficiency of collection of a source for ions of a certain initial energy is defined as the ratio of the number with that initial energy that get through the second slit to the number with that initial energy which get through the first slit. An expression for this efficiency is derived and applied to typical data.

535.338.334 : 535.352 = 3 *see Abstr.* 888

535.338.4 878

Intensity-distribution in molecular spectra: Class I systems of HgCl and HgBr. SASTRY, M. G. *Indian J. Phys.*, 17, *pp.* 141–148, *June*, 1943.—Using the slit-width method and a calibrated quartz Kipp and Zonen std. ribbon lamp, the peak intensities were determined for the bands of the class I system of $HgCl^{35}$ and $HgBr^{31}$ betw. λ2 650 and λ2 400. The transition probabilities for the various bands in each system are derived. The Morse energy function was assumed for drawing the potential-energy curves. The eff. temp. of the source was estimated, assuming Maxwell–Boltzmann distribution.

535.338.4 : 541.147.2 879

The resonance emission of cadmium hydride bands in cadmium photosensitized reactions of hydrocarbons. STEACIE, E. W. R., AND LEROY, D. J. *J. Chem. Phys.*, 12, *pp.* 34–36, *Jan.*, 1944.—An investigation was made in mixtures of ethylene or propane with Cd vapour illuminated with $\lambda\lambda$3 261 and 2 288. With λ3 261 no resonance excitation with ethylene could be detected. With propane, CdH bands were emitted with fair intensity, thus proving that the primary process in the cadmium photosensitized reactions of the paraffins is $Cd(5^3P_1) + RH \rightarrow CdH + R$. With λ2 288 no resonance emission could be detected, but the results were inconclusive.

535.338.4 : 546.17 880

The band spectrum of N_2; weak systems in the visible region. GAYDON, A. G. *Proc. Phys. Soc., Lond.*, 56, *pp.* 85–95, *March*, 1944.—The spectrum of N_2 produced by mild excitation with a silent, ozonizer-type discharge, and with a Tesla coil, was studied. The Goldstein–Kaplan bands at $\lambda\lambda$4 165, 4 432 and 4 728 appear readily and photographs and measurements made with large dispersion are presented. The measurements support Kaplan's vibrational analysis for these bands, but it is believed that other bands in the ultra-violet belong to a different system. The rotational structure and probable type of electronic transition are discussed. A weak new system of bands in the green has been observed. A provisional analysis gives $\omega_e' = 896$, $\omega_e'' = 740$ cm.$^{-1}$. The electronic levels of N_2, the effect of excitation conditions on the band systems of N_2, and the bearing of the results on the determination of the dissociation energy are discussed.

535.338.41-31 : 546.11.02 = 3 881

Molecular spectra of D_2 hydrogen in the ultra-violet region and isotope effect of the D_2 normal state. FUJIOKA, Y. *Z. Phys.*, 119, 3–4, *pp.* 182–184, 1942.—The band spectra of D_2 are photographed and the $2p\sigma'\Sigma \rightarrow 1s\sigma'\Sigma(B \rightarrow A)$ bands analysed. New combinations are found in addition to those previously observed [Abstr. 3210 (1936)]. H. G. S.

535.338.42 : 546.18 882

The band spectrum of phosphorus. I. Rotational structure. II. Alternating intensity and nuclear spin. RAO, K. N. *Indian J. Phys.*, 17, *pp.* 136–140 *and* 149–152, *June*, 1943.—The spectrum, as excited in a discharge tube, was photographed with a Hilger large quartz Littrow spectrograph and the bands (9,21), (5,21), (5,18) and (4,18) measured. Analysis of their rotational structure gives $B_4' = 0{\cdot}2346$ cm.$^{-1}$, $B_5' = 0{\cdot}2323$, $B_9' = 0{\cdot}2255$, $B_{18}'' = 0{\cdot}2799$, $B_{21}'' = 0{\cdot}2736$ cm.$^{-1}$. The const. for $v' = 9$ agrees with that obtained by Herzberg and by Ashley, the others being newly obtained. The absence of any perturbations in the rot. structure of the bands (5,21) and (5,18) shows that the perturbations pointed out by Herzberg must be only vibrational.—Quantitative measurements were made of the alternating intensities of the rot. structure lines for the bands (5,21), (5,18), (9,21), and (6,22). The (5,21) band alone gave the anomalous value 3·3, while for the others, the ratio is 3·0. The intensity ratio leads to a value of nuclear spin as determined by Ashley and Jenkins.

535.339-1 : 535.322.1-1 *see Abstr.* 872

535.339-1 : 621.316.75 883

An electrodynamic slit unit for an infra-red double monochromator. BAKER, E. B., AND ROBB, C. D. *Rev. Sci. Instrum.*, 14, *pp.* 359–361, *Dec.*, 1943.—Electrical control of slit width by means of the unit described permits continuous adjustment as the wavelength is changed, so that const. energy output of the monochromator may be achieved. As a result, per cent absorption is measured directly and the slits are always set for optimum resolving power. An additional feature is curvable slits which are preset for any wavelength desired. The unit is supplied from an amplifier for automatic output control.

535.341 : 621.386.1 : 537.531 *see Abstr.* 919

535.343-1 : 547.46 = 3 884

Infra-red spectra of dicarboxylic acids in crystalline and liquefied forms. SCHÖNMANN, E. *Helv. Phys. Acta*, 16, 4, *pp.* 343–364, 1943.—Using a rock-salt prism spectrometer, absorption spectra of the homologous series of dicarboxylic acids $HOOC-(CH_2)_n-COOH$ for $n = 3, 4, 5, 6$ and 7 were measured in the range of wave numbers of 600 cm.$^{-1}$ to 4 000 cm.$^{-1}$. By using crystal layers prepared by vaporization in high vacuum, a higher degree of accuracy was obtained. The results are discussed in rel. to the mol. structure of the acids. A. E. T.

535.343.4 885

The infra-red absorption spectrum of phosphorus trimethyl. WAGSTAFFE, F. J., AND THOMPSON, H. W. *Trans. Faraday Soc.*, 40, *pp.* 41–42, *Feb.*, 1944.—The spectrum was measured betw. 3–30 μ. Some vibra-

tional frequencies have been correlated with Raman intervals. [See Abstr. 2644 (1940)].

535.343.4 : 546.32 886

A study of absorption lines of potassium vapour under varying conditions of temperature and pressure. BHATTACHARYA, D. K., AND SINHA, S. P. *Indian J. Phys.*, 17, *pp.* 131–134, *June*, 1943.—The spectra were studied using a H continuum as the background. The number of absorption lines increases with the increase in the partial v.p.

535.347 887

Dichroism. WRIGHT, W. D. *Nature, Lond.*, 153, *pp.* 9–12, *Jan.* 1, 1944.—Describes the phenomena of dichroism as exhibited by any coloured medium which has in its spectral transmission curve either a strong absorption band or a peak of transmission subsidiary to the main peak. Oxyhaemoglobin has both, and this explains the observed changes in hue from red to yellow as the thickness of the layer observed or its concentration is decreased. The phenomena are also explained by ref. to plots on the C.I.E. chromaticity chart. J. W. T. W.

535.352 : 535.338.334 = 3 888

On the continuous radiation of the high-pressure mercury column. SCHULZ, P. *Z. Phys.*, 119, 3 *and* 4, *pp.* 167–173, 1942.—The continuum of the h.p. Hg column is essentially a radiation of recombination of the Hg ions [Abstr. 720 (1939)]. Quantitative calculation gives values differing by as much as a factor of 10 between theory and experiment. New temperature determinations from the broadening of spectral lines by electron collision show considerably higher values. A new calculation of the continuous radiation with the improved temperature value gives agreement with experiment. H. G. S.

535.371 : 612 889

Fluorescence as an aid to physiology. PEACOCK, P. R. *Nature, Lond.*, 153, *p.* 136, *Jan.* 29, 1944.

535.375.51 890

Raman spectra of solutions of silver perchlorate in toluene and in water. MURRAY, M. J., AND CLEVELAND, F. F. *J. Amer. Chem. Soc.*, 65, *pp.* 2110–2112, *Nov.*, 1943.—The Raman spectrum of a conc. solution of $AgClO_4$ in toluene shows a band at 167 $cm.^{-1}$ which has no distinct counterpart in the spectrum of aq. solutions of the same salt. Conc. aq. $Hg(ClO_4)_2$ shows a band at the same position.

535.433 891

Fluctuations of light intensity in coronae formed by diffraction. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A*, 18, *pp.* 190–200, *Oct.*, 1943.—Theoretical considerations show that the fluctuations arise owing to interference of the waves diffracted by all the particles, which gives rise to a large number of sharp images of the source in monochromatic light. In white light, these spots must spread out, and produce radial streaks. These deductions are borne out by experiment. Making use of the fluctuations of intensity in monochromatic light, verification has been made of Rayleigh's statistical law of distribution of intensity in the resultant of n vibrations of arbitrary phase. The resultant intensity shows no tendency to close upon the average value, n, but is distributed over a wide range of values.

535.437 892

Interferometric studies of light-scattering in binary liquid mixtures. I. BAI, K. S. *Proc. Indian Acad. Sci. A*, 18, *pp.* 210–217, *Oct.*, 1943.—The fine structure of the opalescent light of two critical-composition mixtures (methyl-alcohol–*n*-hexane and *iso*-butyric-acid–water) was studied at and above the critical solution temp. At the crit. sol. temp. the Brillouin components are absent in either cases, while the central component is intense. The former did not appear in the alcohol-hexane mixture even when its temp. was raised by 29°C. In the acid-water mixture, the shifted components are weakly present at 90°C. and increase in intensity at 120°C. In mixtures of miscible liquids (benzene-*n*-heptane and ethyl-alcohol–water) the Brillouin components are present prominently. The central component, however, shows enhanced intensity. A critical mixture at or above the crit. sol. temp. consists of molecular aggregates whose size is comparable to the wavelength of light and hence does not permit of the propagation of ordered sound-wave trains of thermal origin. The significance of these results with ref. to the Krishnan effect exhibited by binary liquid mixtures, and the X-ray and other evidence, is discussed.

535.557 : 532.517 = 3 893

Thermal effects with flow birefringence. (On the upper limit of the maximum measurable flow birefringence). BJÖRNSTAHL, Y. *Z. Phys.*, 119, 3–4, *pp.* 245–264, 1942.—The optical properties of the liquid often undergo a change with flow gradients below the turbulence limit in consequence of the heating by friction. Gradients of the refr. index occur which give rise to anomalous ray paths. Starting from the thermo-optical theory, an expression for the path of the rays is derived from the characteristic properties: internal friction, heat conductivity, refr. index and corresponding temp. coeff. In many cases it is reflected light which has been measured and the intensity of the direct transmitted light is slight. This may explain some observed anomalies. H. G. S.

535.611 894

Colour designations for lights. KELLY, K. L. *J. Res. Nat. Bur. Stand., Wash.*, 31, *pp:* 271–278, *Nov.*, 1943.—An extension of the ISCC-NBS system of colour names for the description of drugs and medicines, has been made for describing the colours of lights. The chromaticity ranges identified by each hue name are defined by areas on the ICI chromaticity diagram. Comparisons are made between the centres of the proposed hue-name ranges and similar values by other authorities, and with the std. colours recognized in specifications for marine, railway, aviation and traffic signals.

535.65(091) 895

Sixty years of colorimetry. FAWCETT, G. S. *Proc. Phys. Soc., Lond.*, 56, *pp.* 8–21, *Jan.*, 1944.—After an historical survey of the life of Lovibond and the early development of the tintometer, the author describes various forms of the instrument developed for different purposes, and gives a brief account of the C.I.E. colour system, describing the method used for expressing colours on the Lovibond scale in terms of the C.I.E. system. J. W. T. W.

535.653.33 896

Correlation of I.P. Lovibond and Saybolt chromometer colour measurements on motor fuels and refined petroleum. *J. Inst. Petrol.*, 29, *pp.* 357–360, *Dec.*, 1943.—Gives a curve for converting values obtained on the tintometer to those given by the chromometer or vice versa. The precautions to be observed in making colour measurements with these instruments are summarized. J. W. T. W.

535.7 897

Theories of trichromatic vision. HARTRIDGE, H. *Nature, Lond.*, 153, *pp.* 45–46, *Jan.* 8, 1944.—Summarizes the two theories regarding the mechanism by which the eye perceives colour, viz. that which postulates the ability of every cone in the fovea to respond to all 3 colour sensations and that in which 3 different types of cone are postulated. The author concludes that the latter theory more closely fits the facts, but no conclusive evidence is afforded by the phenomena of colour blindness. J. W. T. W.

535.733 898

Some factors and implications of colour constancy. HELSON, H. *J. Opt. Soc. Amer.*, 33, *pp.* 555–566, *Oct.*, 1943.—A treatment, mainly psychological in outlook, of the problem of the apparent constancy of the colour relationships in a scene, independent of the colour of the illumination. A critical account is given of the experimentally established facts and a theory is put forward to provide a possible explanation. J. W. T. W.

535.81 : 535.321.2 *see Abstr.* 871

535.821 : 535.317 *see Abstr.* 869

536.21 899

Heat conduction in an infinite composite solid with an interface resistance. MERSMAN, W. A. *Trans. Amer. Math. Soc.*, 53, *pp.* 14–24, *Jan.*, 1943.—A solution is given of the problem of one-dimensional heat conduction in a body composed of two plane-boundary semi-infinite homogeneous solids of different materials in "imperfect contact" along their interface. The Laplace transformation method is used. L. S. G.

536.24.01 900

Heat transfer and pressure drop in annuli. DAVIS, E. S. *Trans. Amer. Soc. Mech. Engrs*, 65, *pp.* 755–759, *Oct.*, 1943.—New equations for heat transfer and pressure drop in annular spaces for turbulent and laminar flow are given. The equations are checked against data available in the literature and are found to agree. For heat transfer, the D_2/D_1 range tested is from 1·18 to 6 800, and for pressure drop from 1·0044 to ∞. The heat-transfer and friction factors vary with the same powers as the corresp. cases for flow inside tubes. The friction equation reduces to the conventional equation when $D_1 \to 0$.

536.4.032 901

The apparent second-order transition point of polystyrene. ALFREY, T., GOLDFINGER, G., AND MARK, H. *J. Appl. Phys.*, 14, *pp.* 700–705, *Dec.*, 1943.—Above 80° C. the sp. vol. of polystyrene is an explicit function of the temperature, $dV/dT = 0{\cdot}00043$. Below 40°C. the sp. vol. depends upon its past thermal history, $dV/dt = 0{\cdot}00024$, although V is not explicitly fixed by the temp. alone. When a sample is cooled at const. rate, it contracts according to the higher exp. coeff. until some critical region of temp. and then contracts according to the smaller coeff. The position of the crit. temp. region depends upon the rate of cooling. In the intermediate temperature range, complex time effects are observed.

536.422.1 = 3 902

Molecular conditions with free vaporization. METZGER, F., AND MIESCHER, E. *Helv. Phys. Acta*, 16, 3, *pp.* 205–206, 1943.—A short note on the significance of the term "free vaporization," on the characteristics of molecular beams of interest in this connection, and on their investigation. [See Abstr. 903 (1944)]. A. E. T.

536.422.1 : 541.24 = 3 903

Determination of the molecular weight of particles in free vaporization. METZGER, F. *Helv. Phys. Acta*, 16, 4, *pp.* 323–342, 1943.—Describes an electrical double balance, which permits of the simultaneous measurement of 2 mutually perpendicular forces in a vacuum. Vaporization velocities and pressure have been measured. From these data, and the known value of vap. temp., the mol. wt. of the particles in free vaporization from solid bodies is determined. Results are presented for Te, Se, $HgCl_2$, Hg_2Cl_2, NH_4Cl and As. A. E. T.

536.423.4 904

Condensation of vapours. OTHMER, D. F., AND BERMAN, S. *Industr. Engng Chem.*, 35, *pp.* 1068–1077, *Oct.*, 1943.—The film coefficients of heat transfer for the condensation of a total of 18 alcohols, esters and ketones were determined at normal b.p. over a wide range of temperature differences. Vapour velocity and temp. diff. along the tube were held const. The method was modified to allow for possible decomposition of alcohols. The data agree within the low exp. error; they were correlated with the physical properties controlling condensation.

536.629 : 621.317.39 905

Heat capacity of fine wires. KURRELMEYER, B., MAIS, W. H., AND GREEN, E. H. *Rev. Sci. Instrum.*, 14, *pp.* 349–355, *Dec.*, 1943.—[Abstr. 761 B (1944)].

536.631 : 548.0 : 537.228.1 = 3 *see Abstr.* 912

536.653 906

Heat of solution of ethane and propane. BUDENHOLZER, R. A., SAGE, B. H., AND LACEY, W. N. *Industr. Engng Chem.*, 35, *pp.* 1214–1220, *Nov.* 4, 1943.—Experimental measurements were made to determine the change in enthalpy involved when ethane or propane is dissolved in a relatively non-volatile hydrocarbon oil. Comparison is made betw. results obtained from calorimetric determinations and those calculated from the volumetric behaviour of the system.

536.658 : 532.614 *see Abstr.* 839, 840

536.658 : 541.183.26 907

Measurement of adsorption isotherms for mixed vapours. ROWLEY, H. H., AND INNES, W. B. *Proc. Iowa Acad. Sci.*, 48, *pp.* 253–257, 1941.—An apparatus is described which allows the composition of the adsorbed phase to be known and kept const. throughout the isotherm, and which allows the comp. of the vapour phase in equilibrium with the adsorbate to be known, so as to obtain the partial, as well as the total pressures. N. M. B.

536.662 908

Rapid method of correcting fuel-value determinations using the oxygen bomb calorimeter. BATES, H. T. *Proc. Iowa Acad. Sci.*, 48, *pp.* 263–265, 1941.—Correction for the heats of formation of acids present after combustion are made by Kaufmann's method in which a straight-line relationship is derived between the S content of fuel oils and the total acidity of the bomb washings as found by Na_2CO_3 titration. This eliminates the troublesome gravimetric determination of S content. N. M. B.

537.123 = 3 909

Remarks on the nature of the mesotron. YUKAWA, H. *Z. Phys.*, 119, 3–4, *pp.* 201–205, 1942.—The difficulties in the theory of the vector field, the advantages of the pseudo-scalar field, the problem of the radiation of the mesotrons, and the problem of the neutral mesotron are discussed. H. G. S.

537.226.1 : 548.0 = 3 910

Dielectric behaviour of periodates. BAERTSCHI, P. *Helv. Phys. Acta*, 16, 3, *pp.* 218–221, 1943.—Structural considerations lead to the expectation that NH_4IO_4 should exhibit dielectric anomalies. At ordinary temperature the crystal exhibits a high polarization, with a permittivity $\simeq$ 180: this drops steeply at − 20°C. and at − 180°C. is about 10. Tests were carried out on $Ag_2H_3IO_6$, in the form of compressed powder. This also shows a drop in permittivity, which is steepest at about − 45°. $Na_2H_3IO_4$ has a permittivity of 50, but only a slight rate of decrease with increasing temperature. A. E. T.

537.226.1.08 : 621.317.733 911

The measurement of dielectric constant. AMPHLETT, P. H. *J. Soc. Chem. Ind., Lond., pp.* 31–32, *Jan.*, 1944.—[Abstr. 767 B (1944)].

537.228 : 532.63 = 3 *see Abstr.* 841

537.228.1 : 536.631 : 548.0 = 3 912

Polarization and specific heat of KH_2PO_4. ARX, A. VON, AND BANTLE, W. *Helv. Phys. Acta*, 16, *pp.* 211–214, 1943.—The piezo-electric crystals akin to Rochelle salt (KH_2PO_4) are characterized by the existence of elementary regions of spontaneous polarization in the temp. range betw. the Curie points. Connected therewith are the hysteresis effects betw. applied field and electrical polarization. Thermodynamic considerations lead to a relationship betw. the anomaly in sp. ht. and the spontaneous polarization. Measurements of the latter were made on KH_2PO_4 in the region of the upper Curie pt., where the drop is extremely rapid; and from the curve obtained, a theoretical curve for the temperature variation of the anomaly in sp. ht. was calculated. This calculated curve closely matches an experimental curve obtained previously [Abstr. 913 (1944)].

A. E. T.

537.228.1 : 548.0 = 3 913

Effect of electric field strength on the resonance frequencies of the piezo-electric crystals akin to Rochelle salt. BANTLE, W., MATTHIAS, B., AND SCHERRER, P. *Helv. Phys. Acta*, 16, 3, *pp.* 209–211, 1943.—Two cases must be differentiated, according as the excitation is effected by electrodes directly attached to the surface of the crystal, or by inserting the crystal in the air-gap of a capacitor. Explanation for the difference is sought in terms of a dependence on field strength, and is confirmed by tests. A. E. T.

537.312.62 = 3 914

On the theory of supraconduction. ARIYAMA, K. *Z. Phys.*, 119, 3–4, *pp.* 174–181, 1942.—The possibility of explaining the appearance of the supraconductive state is examined by introducing into the Bloch–Hartree model of the metal the magnetic interchanges between the orbital moments of the electrons [Abstr. 2228 (1940)]. H. G. S.

537.523.5 : 621.325 = 3 915

The spectral distribution of the energy of the radiation of high-current carbon arcs. FINKELNBURG, W., AND SCHLUGE, H. *Z. Phys.*, 119, 3–4, *pp.* 206–222, 1942.—The abs. spectral energy distribution was measured with a quartz double monochromator in the range 3 000–13 000 Å, of the Beck arc and the homogeneous carbon high-current arc. Values are derived for the abs. temperature, the black-body temperature and the mean absorption of the emitting vapour, in good agreement with previous evaluations. The crater radiation of the homogeneous high-current arc corresponds exactly to that of a black-body radiator of 3 900°K. after allowing for the intensive CN and C_2 band radiation. A new min. value of 4 120°K. for the sublimation temp. of C at atm. pressure is established. H. G. S.

537.525.8 916

Activation of nitrogen in the presence of mercury. JOSHI, S. S., AND PURUSHOTHAM, A. *Proc. Indian Acad. Sci. A*, 18, *pp.* 218–221, *Oct.*, 1943.—That active N_2 is destroyed by contact with Hg is untenable as a general proposition. Their interaction produces the nitride and a variety of consequences depending upon the nature of conditions. When streamed into neutral Hg vapour, partial de-activation of active N_2 and an excitation of the luminescence of Hg are the chief changes; the intensity of the latter increases with temperature and tends to overshadow that of N_2. When, however, the gas is excited with heated Hg as electrodes, the after-glow is markedly intense; this has been attributed to collisions with the excited and the metastable atoms of Hg, and its ions in the discharge space.

537.525.8 917

The determination of the life of metastable excitation states of neon from residual-current measurements in glow discharges. HOFFMANN, A. *Z. Phys.*, 119, 3–4, *pp.* 223–236, 1942.—Residual currents at the extinction of glow discharges in Ne and Ne-A mixtures are traced to metastable excitation states and are used to determine the mean life of these states. The dependence on pressure shows the life to be limited by the diffusion to the walls and electrodes. Determinations are made of the effective cross-section of the metastable states and the ionization probability of A on collision with Ne atoms in the metastable state. H. G. S.

537.527.5 : 621.325 = 3 918

On the theory of non-stationary discharges. II. The light emission of a modulated high-pressure arc. WEIZEL, W., ROMPE, R., AND SCHULZ, P. *Z. Phys.*, 119, 3–4, *pp.* 237–244, 1942.—A theoretical investigation of the light emission of a d.c. arc discharge modulated with a.c. With small l.f. current modula-

ion the light modulation is ∝ current modulation, ut slightly greater. With large l.f. current modulaion the light modulation lags behind the current nodulation. H. G. S.

537.531 : 535.341 : 621.386.1 919

Roentgen-ray measurements up to 400 kilovolts made with beryllium-window tubes. TROUT, E. D., AND ATLEE, Z. J. *Amer. J. Roentgenol. and Radium Ther.*, 0, *pp.* 648–652, *Nov.*, 1943.—Curves showing the el. of ½-value layer in Cu to inherent filtration, and bsorption data for pyrex, transformer oil, bakelite, l and Cu, at 200–400 kV are given. A method of etermining inherent filtration for h.v. tubes is escribed.

537.534 : 535.336.2 *see Abstr.* 877

537.54 : 535.33.03 *see Abstr.* 875

537.583 920

Thermionic emission from an oxide-coated cathode. AN, H. Y. *J. Appl. Phys.*, 14, *pp.* 552–560, *Oct.*, 943.—The properties of thermionic emission from cathode coated with BaO are studied with accelerating voltages up to 1 300 V. The cathode is indirectly eated and its temperature is measured by a thermoouple. The emitted electrons have a Maxwellian istribution corresp. to the temperature of the cathode. he current rises more steeply than predicted by chottky's theory but begins to bend at the upper end. he variation of the work function and the factor A ith the state of the cathode is studied by glowing the athode at different temperatures. Both the work unction and the factor A vary. No appreciable decay f emission with time is observed. The effect of rawing emission on the work function and the factors is small.

537.591 : 550.385 921

A note on fluctuations in the cosmic radiation bserved in connection with magnetic storms. KORFF, . A. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 217–218, Dec., 1943.

538.081 = 3 922

On the definition of the magnetic quantities. VESTPHAL, W. H. *Z. Phys.*, 119, 3–4, *pp.* 164–166, 942.—It is proposed that J, the magnetization, should e defined by $J = \text{const.} \times B$ instead of $J = \text{const.} \times H$, and diamagnetism chosen as the argument for the ule instead of paramagnetism. Complete agreement s then reached between the equations of electrostatics nd magnetism. H. G. S.

538.561 : 621.396.613 = 3 923

On the generation of a.c. oscillations with the controlled arc. SCHUMANN, W. O. *Arch. Elektrotechn.*, 7, *pp.* 59–86, *Feb.* 28, 1943.—The peak value and wave form of current and voltage, and the power and efficiency, obtaining in an aperiodic or an oscillatory mode circuit connected to a grid-controlled arc, and of the arc itself, are investigated. The ratio betw. burning and blocking periods strongly influences current, voltage and power but, under the supposition of const. burning voltage, rapid ignition and extinction, and complete blocking, the efficiency is independent of this ratio. Long burning and short blocking periods are required with a parallel resonance circuit and the opposite with a series resonance circuit, in order to obtain sine waves. Comparisons are made with the conditions prevailing with high-vacuum tubes and with the Poulsen arc. R. N.

538.7 : 527(09) 924

Some early contributions to the history of geomagnetism. V–VI. HARRADON, H. D. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 197–202, *Dec.*, 1943.—[See Abstr. 2579 (1943)].

539.11 : 517.564.3 : 530.145.61 *see Abstr.* 819

539.133 925

Dipole moments of the chief constituents of lac and rosin. BHATTACHARYA, G. N. *Indian J. Phys.*, 17, *pp.* 153–161, *June*, 1943.—The dipole moment of abietic acid was determined from measurements on its dilute solutions in 1,4 dioxane. Similar measurements were made on dilute dioxane solutions of pure lac resin and soft lac resin. The temperature was 25°C. The values obtained are 1·35, 4·61 and 7·45 Debye units, respectively.

539.152.1 926

On applications of the λ-limiting process to the theory of the meson field. PAULI, W. *Phys. Rev.*, 64, *pp.* 332–344, *Dec.* 1 *and* 15, 1943.—The λ-limiting process for the interaction of an electron with an electromagnetic field is applied to the interaction of a heavy particle (nucleon) with the meson field. The pseudoscalar and vector theories with a coupling const. f of the dimension of length have in this form the character of a weak-coupling theory with no stable isobars existing for $\mu f \ll 1$. The higher approximations for the interactions between nucleons are investigated.

539.153 927

Atomic wave functions for ground states of elements Li to Ne. DUNCANSON, W. E., AND COULSON, C. A. *Proc. Roy. Soc. Edinb. A*, 62, I, *pp.* 37–39, 1944.—The wave functions obtained for the ground states of the atoms Li to Ne are of the simple analytical type [see Abstr. 687 (1936)].

539.153.4 928

Theory of static fields. I. A phenomenological attempt to determine the proper field of an electron. BECK, G. *Phys. Rev.*, 64, *pp.* 366–375, *Dec.*1 *and* 15, 1943.—Elementary electrostatic facts lead to a consistent mathematical scheme which can be applied to Dirac's theory. The phenomenological scheme of quantum field theory has to be abandoned. The proper field of the electron depends essentially on the character of the electron.

539.162 : 539.185.9 = 3 *see Abstr.* 933

539.163.2 929

Beta-decay. KONOPINSKI, E. J. *Rev. Mod. Phys.*, 15, *pp.* 209–245, *Oct.*, 1943.—A review dealing particularly with Fermi's theory of β-decay. Fermi's formulation is outlined, and a formula for the energy distribution of β-particles emitted in allowed transitions is obtained. The experimental evidence for such cases is reviewed, and theoretical and experimental bases for distinguishing between allowed and forbidden transitions are established. The abs. probability of β-decay is examined, and theoretical and experimental facts concerning K-capture are summarized. The Uhlenbeck and Konopinski modification of Fermi's theory seems now to be definitely

disproved. The selection rules of Gamow and Teller are more satisfactory than those of Fermi. A. J. M.

539.166.1 = 3 930

On the angular relation of the two γ-quanta radiated in cascades from an atomic nucleus. KIKUCHI, S., WATASE, Y., AND ITOH, J. *Z. Phys.*, 119, 3–4, *pp.* 185–187, 1942.—The directional correlation is investigated with a tube-counter arrangement, which is briefly described. For ^{38}Cl a directional correlation is established, but not for ^{24}Na. H. G. S.

539.166.8 = 3 931

Nuclear photo-effect with Ti, Ni and Cu, using Li γ-rays. HUBER, O., LIENHARD, O., AND WÄFFLER, H. *Helv. Phys. Acta*, 16, 3, *pp.* 226–227, 1943.—[See Abstr. 1992 (1943)]. As a result of further measurements, on Ti, Ni and Cu, 3 new nuclear photo-effects were found. A. E. T.

539.166.8 = 3 932

Excitation of isomer conditions by nuclear photo-effect. HUBER, O., LIENHARD, O., SCHERRER, P., AND WÄFFLER, H. *Helv. Phys. Acta*, 16, 3, *pp.* 228–229, 1943.—As a result of irradiation with Li-γ rays, the elements Sr and Cd exhibit an activity which must be attributed to an isomer transition. A. E. T.

539.185.9 : 539.162 = 3 933

Some fission products from the irradiation of uranium with fast neutrons. NISHIMA, Y., KIMURA, K., YASAKI, T., AND IKAWA, M. *Z. Phys.*, 119, 3–4, *pp.* 195–200, 1942.—A more detailed description of earlier experiments on the production of Rh, Ru and Sn radioactive isotopes by Li D-neutrons. The opinion is expressed that at least one radioactive isotope can be produced by every element between Br (25) and La (57) by U fission. H. G. S.

539.211 : 546.883 : 548.5 *see Abstr.* 970

539.211 : 549.211 934

Micro-topography of the facets of industrial diamonds. KAYSER, J. F. *Industr. Diamond Rev.*, 4, *pp.* 2–3, *Jan.*, 1944.—Surface markings on a natural facet of a diamond were investigated by a method first described by Hoare and Chalmers. A glass plate is pressed into contact with the surface under examination and the resulting interference fringes are used as contour lines. Monochromatic light is used to obtain narrow fringes and variation of the angle between the glass plate and the surface, up to a limit of about $1\frac{1}{2}°$, enables an estimate to be made of the depth of surface depressions to an accuracy of about $0{\cdot}1\ \mu$. Application of the method to the surface of a polished diamond showed it to be truly flat and free from any trace of scratches, while a specially prepared steel test piece with an extremely fine finish showed considerable surface irregularities. A. W.

539.23 : 621.385.833 935

Electron-diffraction analysis of surface films. GULBRANSEN, E. A. *Electronics*, 17, *pp.* 126–128, *Jan.*, 1944.—[Abstr. 807 B (1944)].

539.384.4 : 531.224.4 *see Abstr.* 823, 824

539.385 : 517.544 *see Abstr.* 796

539.4 : 677 : 620.172 936

Some observations on the measurement of stretch of elastic webbings. LUNGE, G. H. *J. Text. Inst., Manchr*, 35, *pp.* T7–T16, *Feb.*, 1944.—[Abstr. 700 B (1944)].

539.4.015 : 678 937

Theory of filler reinforcement in natural and synthetic rubber. The stresses in and about the particles. REHNER, J., JR. *J. Appl. Phys.*, 14, *pp.* 638–645, *Dec.*, 1943.—For a system containing a single particle rigidly attached to the adjacent medium, the theory of elasticity shows that, for infinitesimal deformations, the stress components within the particle are independent of the radial distance from the origin (particle centre). The stress components at a given point in the surrounding medium depend on the elastic constants of the particle and of the medium, on the radius of the sphere, on the distance from the origin, and on the angle betw. the direction vector and the applied tension. Expressions are given for the average stresses in media containing many (independent) particles. Theoretical values of the bulk moduli of the synthetic rubbers considered in the treatment are derived from sound-velocity data. Curves showing the spatial distribution of radial and shear stresses are presented for a range of values of elastic constants to be expected for different kinds of filler particles and rubberlike materials.

539.433 : 620.178.311.6 938

Damping capacity at low stresses in light alloys and carbon steel, with some examples of non-destructive testing. FROMMER, L., AND MURRAY, A. *J. Inst. Met.*, 70, *pp.* 1–50, *Jan.*, 1944.—[Abstr. 701 B (1944)].

539.434 939

Creep of metals at elevated temperatures—the hyperbolic-sine relation between stress and creep rate. MCVETTY, P. G. *Trans. Amer. Soc. Mech. Engrs*, 65, *pp.* 761–778, *Oct.*, 1943.—The straight-line relation in the log-log plot becomes unreliable when extrapolated into the field of low stresses. Ref. is made to theoretical considerations in favour of the sinh and to tests which support its use. Comparative curves illustrate application to creep data for a wrought 18 Cr-8 Ni alloy tested at 1 500°F. A graphical solution is proposed, and a chart is given for determination of the required constants from creep tests at 2 or more stresses at the same temp.

539.501 940

Evaluation of rheological constants from tensile and compressive tests. LETHERSICH, W., BLAIR, G. W. S. *J. Sci. Instrum.*, 21, *pp.* 27–31, *Feb., and p.* 68, *March*, 1944.—The behaviour of a material in shear is deduced from purely tensile or compressive tests in rod specimens, presuming that Poisson's ratio is known. A simple method of allowing for the change of cross-section in tests at const. load is indicated.

539.501 : 532.133 : 532.77 *see Abstr.* 842

539.501 : 532.137 941

The penetrometer method for determining the flow properties of high-viscosity fluids. PENDLETON, W. W. *J. Appl. Phys.*, 14, *p.* 551, *Oct.*, 1943.—Errata [Abstr. 2227 (1943)].

539.61 942

Influence of an adsorbed (inner) layer on the cohesion of a solid. BENEDICKS, C., AND SEDERHOLM, P. *Nature, Lond.*, 153, *pp.* 109–110, *Jan.* 22, 1944.

539.62 943

Studies in lubrication. XII. Friction behaviour during the slip portion of the stick-slip process. SAMP

SON, J. B., MORGAN, F., REED, D. W., AND MUSKAT, M. *J. Appl. Phys.*, 14, *pp.* 689–700, *Dec.*, 1943.—[See Abstr. 2153 (1943)]. The variation of friction with velocity was determined for typical cases. Most slip traces are symmetrical about their point of inflection, indicating that the kinetic friction remains approx. const. The static friction is greater, and a rapid drop to kinetic friction usually occurs. The kinetic friction is least at the end of slip; the friction/velocity relation is not reversible. The friction does not return immediately to its higher static value when the sliding surfaces come to rest.

541.123.2 : 532.77 *see Abstr.* 843

541.123.2 : 546.331.85 : 548.5 *see Abstr.* 971

541.124 944

Recent advances in the theory of reaction kinetics in solution. BELL, R. P. *J. Chem. Soc.*, *pp.* 629–635, *Dec.*, 1943.—The Tilden lecture survey of the experimental and theoretical treatment of the fundamental problems of reaction velocity in solution during the past 10 years. It deals mainly with the general way in which the collision theory and the transition-state theory account for the value of A in the simple Arrhenius equation for the 3 classes of reactions between (*a*) 2 uncharged mols., (*b*) an ion and an uncharged mol., (*c*) 2 ions. The relative utility of data for solutions and gases is contrasted. N. M. B.

541.124 : 541.145 : 541.64 *see Abstr.* 962

541.127 945

Kinetics of oxidation of cellulose with periodic acid. GOLDFINGER, G., MARK, H., AND SIGGIA, S. *Industr. Engng Chem.*, 35, *pp.* 1083–1086, *Oct.*, 1943.—Hercules Powder linters and regenerated cellulose from $CuO\text{-}NH_3$ solution were oxidized with $NaIO_4$. The rate of this oxidation can be explained by assuming that the sample consists of more easily and more difficultly accessible areas. The amount of the easily accessible (amorphous) material can be estimated by extrapolation. The oxidation of the individual glucose units is a 2-step reaction, which can be followed with fair approximation by a simple kinetic scheme.

541.132 : 532.133 : 541.182.63 *see Abstr.* 959

541.132 : 541.182.63 *see Abstr.* 957, 958

541.132.3 946

Hydrogen-electrode half-cell in polarography. BAUMBERGER, J. P., AND BARDWELL, K. *Industr. Engng Chem.* (*Analyt. Edit.*), 15, *pp.* 639–641, *Oct.* 15, 1943.—The fact that the potential of the anode may be changed at will to potentials betw. $Eh\,0$ and $-0{\cdot}8$ by adjusting the *p*H of the H electrode solution makes it possible to change the applied voltage to values that will give the optimum definition and separation of polarographic waves. Improvements of the Sargent type of polarograph are suggested.

541.132.3 947

A simple glass electrode system for the determination of *p*H of blood and other biological fluids with temperature control. LIN CHUN-YU. *Rev. Sci. Instrum.*, 21, *pp.* 32–33, *Feb.*, 1944.

541.132.3 : 677 948

Determination of the *p*H of textile materials. WAKEHAM, H. R. R., AND SKAU, E. L. *Industr. Engng Chem.* (*Analyt. Edit.*), 15, *pp.* 616–618, *Oct.* 15, 1943.—The *p*H of the extract solution is a function of the quantity of water used in the extraction process. An extrapolation method based on this fact is described for the determination of the *p*H of a fabric. The *p*H of a textile is defined as the *p*H of the water present in the cloth under A.S.T.M. std. conditions of temperature and humidity.

541.133.1 949

Transport numbers of nitric acid in water at 25° from e.m.f. measurements. STONEHILL, H. I. *J. Chem. Soc.*, *pp.* 647–651, *Dec.*, 1943.—The cation transport numbers (t_+) of aq. solutions of HNO_3 ($c = 0{\cdot}001$ to $0{\cdot}2$ mol./l.) were determined by combining activity-coeff. data with measurement of the e.m.f. of concentration cells with transport, quinhydrone electrodes being used. The results are compatible with the theoretical lim. value and limiting slope of the $t_+/\sqrt{c}$ curve, agree with the Jones–Dole and Longsworth equation, but not with the Owen equation, and indicate that, up to $0{\cdot}2$ mol./l., the H ion mobilities in HNO_3 and HCl at the same conc. are equal; the nitrate ion mobilities of KNO_3 (up to $c = 0{\cdot}2$) and of $AgNO_3$ (up to $c = 0{\cdot}1$) are $<$ those of HNO_3.

541.135.5 950

Some observations on the dropping mercury electrode. OELKE, W. C., AND SHIELDS, M. *Proc. Iowa Acad. Sci.*, 48, *pp.* 267–271, 1941.—In place of a polarograph, a potentiometer circuit to measure p.d. and current was used. A 2 200 Ω radio head-set in series with the cell gave audible evidence of an irregularity, hitherto unrecorded, in the growth of the Hg drop. Results were supported by a c.r.o., and explanations are discussed. N. M. B.

541.141.7 = 3 951

Photo-dissociation of diatomic molecules into ions by irradiation in the wavelength range of 2 200 Å to 1 700 Å. HÄLG, W. *Helv. Phys. Acta*, 16, 4, *pp.* 371–391, 1943.—Describes a series of experiments in which the vapours of the halides of In and Ga have been dissociated into metal ions (In and Ga respectively) and halogen ions by ultra-violet radiation of various compositions from spark gaps. It was possible to relate the degree of ion formation to the wavelength of the radiation producing the dissociation and to derive various conclusions concerning the nature of the phenomenon. A. E. T.

541.144 952

The photo-reduction of ferric chloride in aqueous solutions in presence of organic acids and sugars. BAVDEKAR, P. R. *J. Univ. Bombay*, 12, *pp.* 47–56, *Nov.*, 1943.—Full tabulated data are reported for investigations made with the use of ceric sulphate titration to determine Fe. Results show that the photo-reduction in presence of org. acids (oxalic, citric, tartaric) and sugars (glucose, sucrose, laevulose) is a zeromolecular reaction; the temp. coeffs. are almost 1 in each case, showing that the reactions are ideally photochemical; the rate of reaction increases with rise of radiation frequency, and $\propto$ intensity of incident light; quantum efficiency is a max. at $\sim 0{\cdot}10$ $FeCl_3$ conc., decreases as λ of the radiation is increased, and is markedly increased by temp. especially at higher temps. N. M. B.

541.145 : 541.124 : 541.64 *see Abstr.* 962

541.147.2 : 535.338.4 *see Abstr.* 879

541.182.4.043 953

Determining the mechanical stability of emulsions. MERRILL, R. C., JR. *Industr. Engng Chem.* (*Analyt. Edit.*), 15, *pp.* 743–746, *Dec.* 15, 1943.—The reciprocal of the initial rate of separation at a const. centrifuge speed is taken as a quantitative index of the mechanical stability of the emulsion. The method is applied to water-in-oil and oil-in-water emulsions stabilized by lecithin, soaps and vegetable gums. Definite effects of the age of the emulsion on its mechanical stability as determined by this method have been found in the case of soap and saponin-stabilized emulsions.

541.182.6 954

A study of Bredig platinum sols. MINDEL, J., AND KING, C. V. *J. Amer. Chem. Soc.*, 65, *pp.* 2112–2115, *Nov.*, 1943.—Bredig Pt sols were prepared in H_2O, HCl and HNO_3, in atmospheres of air, O_2 and N_2. The composition and stability are only slightly affected by variations in the dispersion medium and in the gaseous atmosphere. There is no change in the Pt content of the micelle on coagulation with acids. Pt sols prepared by arcing in the gas phase are similar to normal Bredig sols in colour, charge, stability and catalytic effect.

541.182.6 955

Dehydrated graphite sols. PORTER, B. H. *Rev. Sci. Instrum.*, 15, *p.* 13, *Jan.*, 1944.

541.182.6.041 956

Sedimentation volumes and rigidity in suspensions of sodium soaps in mineral oils. GALLAY, W., AND PUDDINGTON, I. E. *Canad. J. Res. B*, 22, *pp.* 16–20, *Jan.*, 1944.—The sedimentation volume increases greatly with decrease in viscosity index of the oil. Flow/pressure relations, determined with a torsional viscosimeter, show that suspensions with large sedimentation volumes possess rigidity, whereas the flow is Newtonian in suspensions having small sedimentation volumes. Variation in sedimentation volume is therefore caused by difference in the tendency toward agglomeration or attraction between particles, leading to the formation of branched chains and scaffolding structures.

541.182.63 : 541.132 957

The electrochemical properties of clay minerals and the differentiation of hydrogen clays and bentonites by electrochemical methods. I. Kaolinite and kaolinitic clays. MUKHERJEE, J. N., MITRA, R. P., AND MITRA, D. K. *J. Phys. Chem.*, 47, *pp.* 543–549, *Nov.*, 1943.—The titration curves and other electrochemical features are given and discussed for kaolinite and for H clays prepared from the entire clay fraction of two lateritic soils which gave dehydration curves characteristic of kaolinitic minerals. Evidence on the acid character and composition of the mineral is obtained.

N. M. B.

541.182.63 : 541.132 958

The electrochemical properties of clay minerals and the differentiation of hydrogen clays and hydrogen bentonites by electrochemical methods. II. Montmorillonitic clays and bentonites. MITRA, R. P., BAGCHI, S. N., AND RAY, S. P. *J. Phys. Chem.*, 47, *pp.* 549–553, *Nov.*, 1943.—The titration curves and other features are given for one H clay and two H bentonites which give dehydration curves similar to those of montmorillonitic clay minerals. The clay and H bentonites were prepared, respectively, from the entire clay fraction of a neutral calcareous soil and from bentonites from localities in India. Evidence on composition is obtained. N. M. B.

541.182.63 : 541.132 : 532.133 959

Effect of concentration and *p*H on the viscous and electrochemical properties of hydrogen bentonites. MUKHERJEE, J. N., SEN GUPTA, N. C., AND INDRA, M. K. *J. Phys. Chem.*, 47, *pp.* 553–577, *Nov.*, 1943.—Measurements are reported and other available data are reviewed leading to conclusions on the variation with conc. of sp. conductivity, cataphoretic velocity, *p*H, extinction coeff., coeff. of viscosity, and apparent sp. gravity. Results suggest that as conc. rises, aggregates are first formed and that at a still higher conc. these form some sort of structure which possesses yield value. Variation in the yield value, consistency and thixotropy with *p*H are closely related to buffer capacities calculated from titration curves with NaOH. N. M. B.

541.183 : 532.61 *see Abstr.* 836

541.183.03 : 677.3 960

The adsorption of sodium alkyl sulphates by wool and other fibres. AICKIN, R. G. *J. Soc. Dy. Col., Bradford*, 60, *pp.* 60–65, *March*, 1944.—The adsorption was studied under a variety of conditions; the single long-chain alkyl sulphate ion is involved. This ion reacts with the basic groups present in wool and behaves as a colourless dye, in that the adsorbed ions cannot be removed by a simple washing process. The extent of the adsorption increases with increasing *p*H, and the conc. of the sulphate solution is reduced to practically zero if there is less present initially than corresponds to the acid-combining capacity of the wool. The retarding and levelling action that these compounds exert in dyebaths can be explained in terms of this adsorption, since the dye sulphonic acids and the alkyl sulphates are competing for the same basic groups in the wool fibre, or active centres in other fibres. The extent and the rate of adsorption is increased by the addition of electrolytes, the ion of sign opposite to that of the long-chain ion being responsible. As in the case of the effect on the interfacial tensions, the univalent ions fall into a lyotropic series. Measurements were made of the adsorption by other textile fibres, where similar effects were observed. The extent of the adsorption depends largely upon the number of basic groups present in the fibre.

541.183.26 : 536.658 *see Abstr.* 907

541.24 : 536.422.1 = 3 *see Abstr.* 903

541.265 : 535.324 : 532.14 : 532.612 *see Abstr.* 837

541.56 : 546.21 961

A direct experimental determination of the electron affinity of oxygen. VIER, D. T., AND MAYER, J. E. *J. Chem. Phys.*, 12, *pp.* 28–34, *Jan.*, 1944.—The electron affinity of O atoms for 1 electron, the neg. of the energy change at abs. zero of the reaction $e^- + O_{gas} \rightarrow O^-_{gas}$, was determined to be $(70{\cdot}8 \pm 2{\cdot}0)$ kcal./mole. The method used was to determine

the ratio of neg. ions to electrons leaving a hot filament surface exposed to O_2 gas at a l.p.

541.64 : 541.145 : 541.124 962

An application of probability considerations to the mechanism of the photochemical polymerization of acetylene. DUNICZ, B. L. *J. Chem. Phys.*, 12, *pp.* 37–45, *Jan.*, 1944.—[See Abstr. 2603 (1941)].—If the probabilities of the formation of products of the addition and breaking of the easily dissociated single C-C bonds in the unstable products, in the respective stages of reaction, are assumed equal, quantum yields and heats of reaction may be calculated, which are in fair agreement with data found experimentally.

541.68 : 547.21 : 532.133 *see Abstr.* 830

543 : 669.1 963

A combined method of chemical analysis for cast iron, malleable iron and steel. SOBERS, W. B. *Amer. Foundrym., pp.* 2–5, *Jan.*, 1944.—The method results in saving in the time required for completing a number of determinations, as well as in the handling and weighing operations of the sample itself. Material saving is realized in the amount of initial sample required and in reduced quantities of chemicals and filter papers. Less std. equipment and workroom space are needed. M.-V.

544.6 : 535.33 *see Abstr.* 873

544.6 : 63 = 6 964

Qualitative spectro-analysis of elements in vegetables. AMBROSIS, R. J. *Publ. Fac. Cienc. Fis.-Mat. La Plata, No.* 168, *pp.* 329–344, *June*, 1943.—A report, with several plates of spectra, of a qualitative examination of common fruits and vegetables.

545.37 965

Polarographic technique. STOCK, J. T. *Metallurgia, Manchr, pp.* 155–158, *Jan.*, 1944.—The principle of the polarograph is discussed and equipment described, actual examples of polarograms being shown which have been automatically recorded by photographic means, with consequent saving of time. Many variations in technique to suit different requirements are quoted. M.-V.

545.37 : 551.510.41 : 546.214 966

A method for the continuous measurement of the local concentration of atmospheric ozone. GLUCKAUF, E., HEAL, H. G., MARTIN, G. R., PANETH, F. A. *J. Chem. Soc., pp.* 1–4, *Jan.*, 1944.—The principle of the method is the liberation of I from buffered KI solution, and its electrometric titration at short intervals with very dilute $Na_2S_2O_3$ solution. The small current resulting from the depolarization of a pair of Pt electrodes by the I is amplified by a 2-stage valve amplifier, and made to actuate the automatic burette, containing the $N_2S_2O_3$ solution, when the I conc. reaches a given value.

545.82 : 535.33 *see Abstr.* 874

545.82 : 546.84 : 546.78 : 535.33.03 *see Abstr.* 876

546.11.02 : 535.338.41-31 = 3 *see Abstr.* 881

546.17 : 535.338.4 *see Abstr.* 880

546.18 : 535.338.42 *see Abstr.* 882

546.21 : 541.56 *see Abstr.* 961

546.214 : 551.510.41 : 545.37 *see Abstr.* 966

546.32 : 535.343.4 *see Abstr.* 886

546.331.85 : 541.123.2 : 548.5 *see Abstr.* 971

546.432 : 551.482.214 : 551.510.41 *see Abstr.* 980

546.78 : 546.84 : 545.82 : 535.33.03 *see Abstr.* 876

546.84 : 546.78 : 545.82 : 535.33.03 *see Abstr.* 876

546.883 : 539.211 : 548.5 *see Abstr.* 970

547.21 : 541.68 : 532.133 *see Abstr.* 830

547.46 : 535.343-1 = 3 *see Abstr.* 884

548.0 : 532.782 *see Abstr.* 844

548.0 : 536.631 : 537.228.1 = 3 *see Abstr.* 912

548.0 : 537.226.1 = 3 *see Abstr.* 910

548.0 : 537.228.1 = 3 *see Abstr.* 913

548.0 : 553.621 967

The orientation of quartz crystals. SHORE, S. X. *Communications*, 23, *pp.* 30, 31, 33, 34, 36, 37, 115, 117, *Nov.*, 1943.—Describes methods of mounting the mother quartz in correct alignment for manufacturing BT-cut crystals. A mechanical method can be used if the raw quartz shows characteristic crystal faces, but a more precise X-ray diffraction method has been developed. An outline of the theory is given and the apparatus is briefly described. The birefringence of quartz is also used for locating the *Z*-axis, by means of optical equipments called the conoscope and stauroscope. Etch-patterns are widely used for roughly locating the crystal axes and detecting twinning. The variation of frequency with temperature for typical BT-cut crystals is illustrated. C. F. B.

548.1 : 549.211 968

Diamond geometry. GRODZINSKI, P. *Industr. Diamond Rev.*, 4, *pp.* 49–53, *March*, 1944.—An elementary discussion of the crystal structure (octahedron) of the diamond. The article is largely historical and the author discusses the medieval method for approximating the value of $\sqrt{2}$. A table of crystals of the cubic system is given. L. S. G.

548.1 : 553.621 969

Raw quartz, its imperfections and inspection. WILLARD, G. W. *Bell Syst. Techn. J.*, 22, *pp.* 338–361, *Oct.*, 1943.—Describes various imperfections of raw quartz with particular reference to the use of such quartz in the manufacture of piezo-electric circuit elements. The optical examination of quartz is described (by polarized light and the refractoscope), and the photographic recording of the results is considered. Illustrations are given. J. T.

548.5 : 539.211 : 546.883 970

Controlled crystal growth in tantalum ribbons. MROWCA, B. A. *J. Appl. Phys.*, 14, *pp.* 684–689, *Dec.*, 1943.—Microscopic examination of surfaces developed in Ta ribbons on heat treatment in vacuum shows a dependency of surface structure on whether a.c. or d.c. supply is used for the heating current. Further modification of surface structure results due to recrystallization over 1 900°K. to 2 500°K. Grain growth increases exponentially with the temperature. An optimum amount of cold-working of the samples before heat treatment results in exaggerated grain growth yielding large single crystals.

548.5 : 546.331.85 : 541.123.2 971

The binary system $NaPO_3$-$Na_4P_2O_7$. MOREY, G. W., AND INGERSON, E. *Amer. J. Sci.*, 242, *pp.* 1–6,

Jan., 1944.—In the binary system $NaPO_3$-$Na_4P_2O_7$ there is a eutectic, at 552° and 0·31 weight fraction $Na_4P_2O_7$, at which the crystalline phases are $NaPO_3$ and $Na_5P_3O_{10}$, the only binary compound between the two end members. $Na_5P_3O_{10}$ melts incongruently at 622°, forming crystals of $Na_4P_2O_7$ and liquid containing 0·495 weight fraction $Na_4P_2O_7$. Optical properties of these three compounds are given.

548.73 : 620.179 : 669.71 972

The mottling of aluminium alloy radiographs. GLAISHER, W. H., BETTERIDGE, W., AND EBORALL, R. *J. Inst. Met.*, 70, *pp.* 81–89, *Feb.*, 1944.—The mottled appearance observed in radiographs of Al alloy castings was investigated and shown to be a diffraction effect due to the irregular distribution of Laue spots from individual crystal grains, and the weakening of the transmitted beam when this diffraction occurs. No method of obviating the defect has been found.

548.73 : 669.21 : 669.3 973

Kinetics of the order-disorder transformations in Cu-Au. KÄLLBÄCK, O., NYSTRÖM, J., AND BORELIUS, G. *IngenVetenskAkad. Handl., No.* 157, [21 *pp.*], 1941.—X-ray measurements were made with a view to obtaining further information regarding the transformations which occur in a 50 atomic % Cu-Au alloy over the range 228° to 430°C. The transition point is 408°C. The results are discussed in the light of Borelius' theory, which is shown to be capable of explaining the various transitions and also the hysteresis effects observed. R. W. P.

549.211 : 539.211 *see Abstr.* 934

549.211 : 548.1 *see Abstr.* 968

549.211 : 621.9 : 620.179 : 621.386.1 974

X-rays and industrial diamonds. TUNNICLIFFE, E. J. *Industr. Diamond Rev.*, 4, *pp.* 26–28, *Feb.*, 1944.—[Abstr. 809 B (1944)].

550.384 : 523.746 975

Solar and magnetic data, July to September, 1943, Mount Wilson Observatory. NICHOLSON, S. B., AND MULDERS, E. S. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 245–246, *Dec.*, 1943.

550.385 : 537.591 *see Abstr.* 921

550.837 : 621.389 976

Metal locators. BLANKMEYER, W. H. *Electronics*, 16, *pp.* 112–115, 236 *and* 238, *Dec.*, 1943.—[Abstr. 811 B (1944)].

550.837 : 621.389 977

Locating buried cables electrically. GREENIDGE, R. M. C. *Bell. Lab. Rec.*, 22, *pp.* 106–109, *Nov.*, 1943.—[Abstr. 810 B (1944)].

551.3.053 : 551.482.2 : 551.577 *see Abstr.* 981

551.465 978

Counterpart of the Davidson current. MEARS, E. G. *Nature, Lond.*, 153, *pp.* 346–347, *March* 18, 1944.

551.482.2 : 551.3.053 : 551.577 *see Abstr.* 981

551.482.214 : 546.432 : 551.510.41 *see Abstr.* 980

551.508.5 : 621.317.39 979

A thermal anemometer for low-velocity flow. SEBAN, R. A., HILLENDAHL, W. H., GALLAGHER, E. J., AND LONDON, A. L. *Trans. Amer. Soc. Mech. Engrs*, 65, *pp.* 843–846, *Nov.*, 1943.—[Abstr. 762 B (1944)].

551.510.41 : 546.214 : 545.37 *see Abstr.* 966

551.510.41 : 551.482.214 : 546.432 980

On the radon-content of the atmosphere and the radium-content of river-water. HESS, V. F. *Terr. Magn. Atmos. Elect.*, 48, *pp.* 203–206, *Dec.*, 1943.—Results of determination of radon-content of the air in New York and of the radium-content of the Susquehanna River.

551.577 : 551.482.2 : 551.3.053 981

Rainfall, rivers and erosion. RASTALL, R. H. *Geol. Mag., Lond.*, 81, *pp.* 39–44, *Jan.–Feb.*, 1944.—The geological potency of a given rainfall depends upon its concentration in time or seasonal frequency. Nearly all erosion is due to flood conditions and although these hinder the erosion of rock floors they give rise to unusually active denudation for a long time. The main factors responsible for the erosion of river beds are solution, oxidation, hydration and hydrolysis, while the formation of H_2SO_4, rather than CO_2, and the instability of mineral compounds, play a part. R. S. R.

553.621 : 548.0 *see Abstr.* 967

553.621 : 548.1 *see Abstr.* 969

578.087.77 : 533.17.08 *see Abstr.* 846

612 : 535.371 *see Abstr.* 889

629.12 : 513.732 : 518 *see Abstr.* 802

629.12 : 532.322 *see Abstr.* 831

629.12 : 532.583.4 *see Abstr.* 835

629.12.037 : 534.13 : 533.6.013.42 *see Abstr.* 847

63 : 544.6 = 6 *see Abstr.* 964

669.1 : 543 *see Abstr.* 963

669.21 : 669.3 : 548.73 *see Abstr.* 973

669.3 : 669.21 : 548.73 *see Abstr.* 973

669.71 : 620.179 : 548.73 *see Abstr.* 972

677 : 541.132.3 *see Abstr.* 948

677.3 : 541.183.03 *see Abstr.* 960

678 : 539.4.015 *see Abstr.* 937

771.3 : 534.372 *see Abstr.* 855

778.3 : 517.512.2 *see Abstr.* 791

782/785 : 331.8 982

Industrial music and morale. HALPIN, D. D. *J. Acoust. Soc. Amer.*, 15, *pp.* 116–123, *Oct.*, 1943.

782/785 : 331.8 983

Music as a safety factor. HOUGH, E. *J. Acoust. Soc. Amer.*, 15, *p.* 124, *Oct.*, 1943.

782/785 : 331.8 984

Attitudes toward types of industrial music. KERR, W. A. *J. Acoust. Soc. Amer.*, 15, *pp.* 125–130, *Oct.*, 1943.

782/785 : 331.8 985

Programming music for industry. SELVIN, B. *J. Acoust. Soc. Amer.*, 15, *pp.* 131–132, *Oct.*, 1943.

782/785 : 331.8 986

The statistical method in determining the effects of music in industry. CARDINELL, R. L. *J. Acoust. Soc. Amer.*, 15, *pp.* 133–135, *Oct.*, 1943.